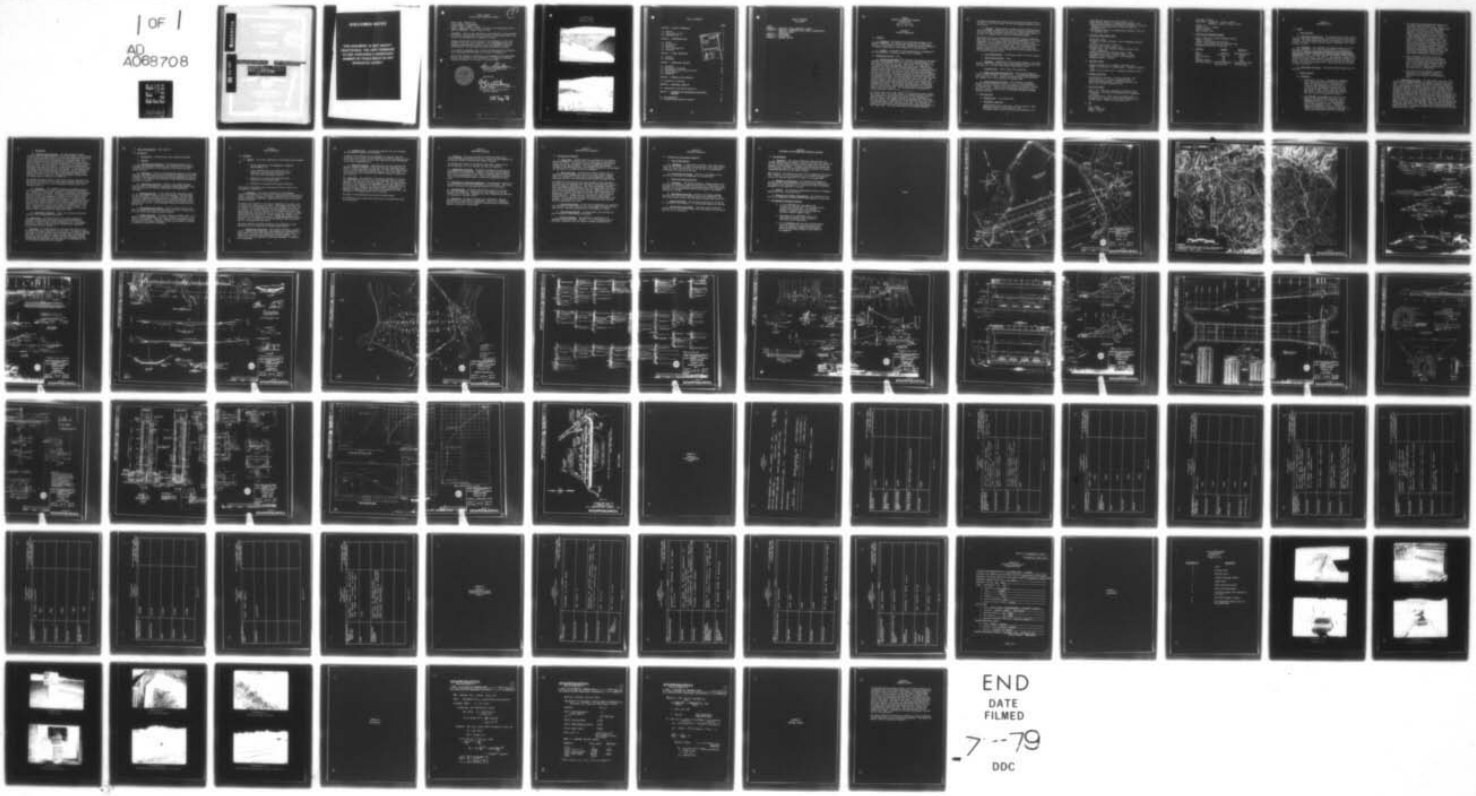
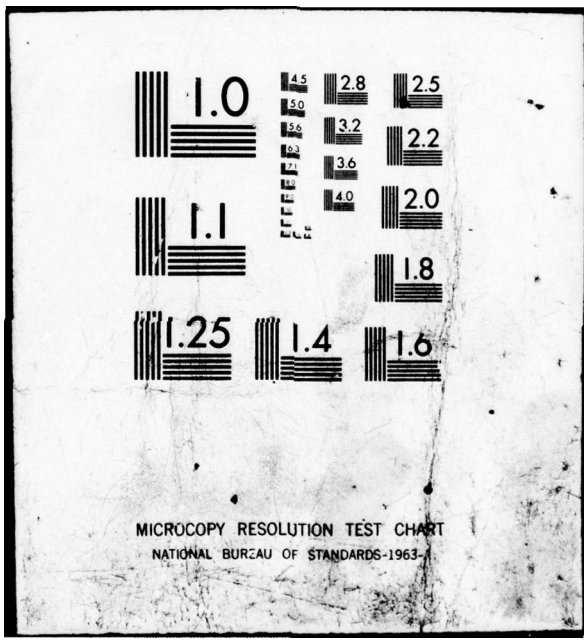
AD-A068 708 D'APPOLONIA CONSULTING ENGINEERS INC PITTSBURGH PA F/G 13/2
NATIONAL DAM INSPECTION PROGRAM. GLENDALE DAM, NDI ID NUMBER 91--ETC(U)
SEP 78 DACW31-78-C-0049

UNCLASSIFIED NL

1 OF 1
AD A068708



END
DATE FILMED
7-79
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Glendale Dam, NDI ID Number 912.
Susquehanna Basin, Beaver Dam Run,
Cambria County, Pennsylvania.
Phase I Inspection Report.

Contract No. DACW31-78-C-0049

(12) 76 P.

(15)

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DDC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

NAME OF DAM: Glendale Dam
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Cambria County
STREAM: Beaverdam Run, secondary tributary of the Susquehanna River
DATE OF INSPECTION: August 9 and 16, 1978

ASSESSMENT: Based on the evaluation of the conditions as they existed on the dates of inspection and as revealed by visual observations, the condition of Glendale Dam is assessed to be good.

Seepage was observed at the junction of the embankment and the left abutment at the toe level of the dam. It is recommended that this seepage be monitored and recorded. Also, the embankment should be mowed annually, and the broken spillway boom should be repaired.

It is further recommended that a formal warning system be developed to alert the downstream residents in the event of emergencies.

The spillway capacity is classified to be inadequate (85 percent PMF). However, the spillway is not considered to be seriously inadequate because the capacity is in excess of 50 percent PMF.

Lawrence D. Andersen, P.E.
Vice President

Approved By:

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

28 Sep 78

GLENDALE DAM
NDI I.D. NO. 912
AUGUST 9, 1978

Upstream Face

Downstream Face

TABLE OF CONTENTS

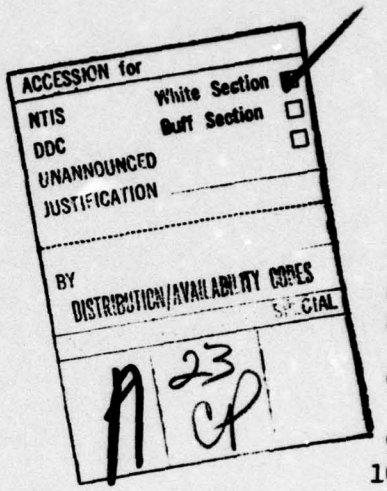


TABLE OF CONTENTS
(Continued)

PHASE I
NATIONAL DAM INSPECTION PROGRAM
GLENDALE DAM
NDI I.D. NO. 912
DER I.D. NO. 11-101

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. The inspection was performed pursuant to the authority granted by The National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

b. Purpose. The purpose of this inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Work

a. Dam and Appurtenances. The Glendale Dam consists of an earth embankment approximately 1800 feet long with a maximum height of 60 feet from the downstream toe and a crest width of 25 feet (Plate 1). The combined primary and emergency spillway for the reservoir is located on the right abutment (looking downstream). A 60-foot-wide concrete ogee section at a level 8-1/2 feet above the normal pool level and 10-1/2 feet below the dam crest level constitutes the emergency spillway for the dam. The primary spillway for the reservoir consists of four ungated orifices located through the concrete ogee section of the emergency spillway. The two-foot-high by five-foot, five-inch-wide orifices are at a level 19.7 feet below the crest of the dam. The orifice entrances are flared and protected with steel trash racks. A floating timber crash boom prevents the large pieces of debris from reaching the sluices. The spillways discharge into a 40-foot-wide, 224-foot-long concrete chute section which terminates at a stilling basin at the toe of the dam. The stilling basin is equipped with energy dissipator blocks.

The outlet works for the dam consist of a reinforced concrete conduit and intake tower. The outlet pipe is a horseshoe section (five feet, five inches by six feet) which is founded on rock throughout its 400-foot length. The conduit entrance is equipped with trash racks and stop logs and it terminates at a stilling basin on the left side of the spillway chute at the toe level of the dam. Flow through the conduit is controlled by a motor-operated sluice gate with controls in the intake tower. The sluice gate can also be operated manually.

An eight-inch bypass valve constitutes the low flow control for the reservoir. This outlet system is also the emergency drawdown facility for the dam.

b. Location. Glendale Dam is located in Prince Gallitzin State Park, four miles upstream from the town of Coalport on Beaverdam Run in Chest and White Townships, Cambria County, Pennsylvania (Plate 2). The dam is a combined flood control and recreation project.

Downstream from the dam, Beaverdam Run meanders through a 1500-foot-wide valley and flows into Clearfield Creek approximately 1-1/2 miles downstream. It is estimated that approximately 25 homes in the community of Beaver Valley located in this reach would be affected by a flood due to a failure of Glendale Dam. It is considered that failure of the dam could also cause significant loss of life and property damage in the town of Coalport and further downstream along the course of Clearfield Creek.

c. Size Classification. Intermediate (based on 60-foot height).

d. Hazard Classification. High.

e. Ownership. Commonwealth of Pennsylvania (address: Mr. James Boswell, Chief of Operations, Pennsylvania Department of Environmental Resources, P.O. Box 2063, Harrisburg, Pennsylvania 17120).

f. Purpose of Dam. Flood control and recreation.

g. Design and Construction History. The dam was designed by Gannett Fleming Corddry & Carpenter, Inc., of Harrisburg, Pennsylvania, with completion in 1958. The dam was constructed by Frank Donatelli and Company, Inc., with completion in November 1960.

h. Normal Operating Procedure. The reservoir is normally maintained at Elevation 1427, the sill level of the uncontrolled primary spillway, leaving 19 feet of freeboard to the top of the dam at Elevation 1446. Inflow occurring when the lake level is at or above the primary spillway level is discharged through the primary spillway orifices.

1.3 Pertinent Data

a. Drainage Area - 41.9 square miles

b. Discharge at Dam Site

Maximum known flood at dam site - 900 cfs (July 24, 1972)
Warm water outlet at pool elevation - N/A
Diversion tunnel low pool outlet at pool elevation - N/A

Gated spillway capacity at pool elevation - N/A
Gated spillway capacity at maximum pool elevation - N/A
Ungated spillway capacity at maximum pool elevation - 1050 cfs (primary) at Elevation 1435.5; 9780 cfs (total) at Elevation 1446
Total spillway capacity at maximum pool elevation - 9780 cfs at Elevation 1446

c. Elevation (USGS Datum) (feet)

Top of dam - 1446
Maximum pool-design surcharge - 1435.5 (emergency spillway crest)
Full flood control pool - 1435.5
Recreation pool (normal pool) - 1427
Spillway crest - 1427 (primary spillway concrete sill); 1435.5 (emergency)
Upstream portal invert diversion tunnel - 1384
Downstream portal invert diversion tunnel - 1383
Streambed at center line of dam - 1380 (estimated)
Maximum tailwater - Unknown

d. Reservoir (feet)

Length of maximum pool - 28,000± at Elevation 1446
Length of recreation pool (normal pool) - 23,000 at Elevation 1427
Length of flood control pool - 23,000± at Elevation 1435.5

e. Storage (acre-feet)

Recreation pool (normal) - 25,300 at Elevation 1427
Flood control pool - 41,200 at Elevation 1435.5
Design surcharge (maximum) - 68,000 at Elevation 1446
Top of dam - 68,000 at Elevation 1446

f. Reservoir Surface

Top of dam - 2850 acres (estimated at Elevation 1446)
Maximum pool - 2140 acres at Elevation 1435.5 (emergency spillway)
Flood control pool - 2140 acres at Elevation 1435.5
Recreation pool (normal) - 1600 acres at Elevation 1427
Spillway crest - 1600 acres at Elevation 1427

g. Dam

Type - Earth
Length - 1800 feet
Height - 60 feet

Top width - 25 feet
Side slopes - Downstream: 2.5H:1V, 3.0H:1V
Upstream: 2.5H:1V, 3.0H:1V, 3.5H:1V
Zoning - No
Impervious core - Unknown
Cutoff - Partial
Grout curtain - Yes

h. Diversion and Regulating Tunnel

Type - 5.5-foot by 6.0-foot horseshoe conduit
Length - 400 feet
Closure - Sluice gate and stop logs
Access - Gate controls are at the intake tower
Regulating facilities - Sluice gate

i. Spillway

	Primary	Emergency
Type -	Orifice	Ogee-crested weir
Length -	4 @ 5.5' = 22'	60 feet
Crest Elevation -	1427	1435.5
Gate -	No	No
Upstream channel -	Lake	Lake
Downstream channel -	Concrete chute with stilling basin	Concrete chute with stilling basin

SECTION 2
ENGINEERING DATA

2.1 Design

a. Data Available

(1) Hydrology and Hydraulics. The emergency and primary spillway tailwater and outlet conduit rating curves are included in the design drawings. The inflow hydrograph and the flood volume were described in a report prepared by Gannett Fleming Corddry & Carpenter, Inc., dated February 17, 1958.

(2) Embankment. The embankment was designed based on a report by Berger Associates, Inc., Consulting Engineers, of Harrisburg, Pennsylvania (Report on Subsurface Exploration, Proposed Recreation and Flood Control Dam, Beaverdam Run, White Township, Cambria County, Pennsylvania, 1956). The report includes the results of the subsurface exploration and laboratory test results. The embankment design report prepared by Gannett Fleming Corddry & Carpenter was not available for review. They reported that their records for this dam were destroyed during the Tropical Storm Agnes flood. These data were not available in state files either.

(3) Appurtenant Structures. Structural design analyses were not available.

b. Design Features

(1) Embankment

a. As designed, the dam is a homogeneous embankment with a three-foot-thick sand and gravel filter under the downstream slope. The sand drain starts 65 feet downstream from the center line of the dam and terminates at the rock fill at the toe of the dam. Plate 3 shows the typical dam section. Details of the sand drain and the rock toe trench are illustrated in Plate 4.

b. The embankment was designed to have a 2.5 to 1 slope on the upstream face from crest level to Elevation 1436 and 3.0 to 1 below this level to Elevation 1416 and 3.5 to 1 from Elevation 1416 to the upstream toe level. Downstream slopes were designed to be 2.5 to 1 from crest level to a 10-foot berm at Elevation 1416 and 3 to 1 below this elevation to the toe of the dam.

c. The subsurface investigation was conducted in two phases during 1956 and 1957. Plate 5 shows the location of the borings. Boring logs are included in Plate 6. The subsurface profile at the site consists of alluvial deposits of clayey silt to silty clay with shale fragments extending from the surface to a depth varying from 5 to 14 feet. This material is underlain by medium sand to silty sand, 7 to 10 feet in thickness. Soft gray shale layers varying in thickness from 3 to 33 feet were encountered at an average depth of 30 feet from the ground surface. Soft gray shales were underlain by hard gray shale. The subsurface investigation report indicates that discontinous coal seams 8 inches to 2 feet thick were encountered at various depths.

d. Over a distance of 200 feet on the left abutment and 800 feet on the right abutment, a cutoff trench was excavated to the top of rock. The foundation was grouted through the base of the cutoff trench. Plates 3 and 7 show the extent of foundation grouting and the cutoff trench, respectively.

e. Soil testing for the embankment materials consisted of classification, compaction, unconfined shear strength, and permeability tests.

c. Appurtenant Structures. The appurtenant structures of the dam consist of combined primary and emergency spillways and outlet works. A 60-foot-wide concrete ogee section located at Elevation 1435.5 constitutes the emergency spillway control section (Plate 8). The primary spillway for the dam consists of four orifices located through the ogee weir of the emergency spillway. The invert of the orifices is located at Elevation 1426.33. A concrete sill at the entrance of primary spillway maintains the lake level at Elevation 1427. The spillways discharge into a 40-foot-wide chute which terminates at a stilling basin at the toe of the dam (Plate 9). The outlet works for the dam consist of a horseshoe conduit (five feet, five inches by six feet) located near the right abutment (Plate 10). The flow through this conduit is controlled by a sluice gate. Gate controls are located at the intake tower (Plate 11). The gate controls can be mechanically or manually operated. An eight-inch bypass valve constitutes the low level flow control for the dam.

d. Design Data

(1) Hydrology and Hydraulics. The 1958 engineer's report indicates that the design flood for the dam was based on the occurrence of two successive design storms, with five days between the end of the first storm rainfall and the beginning of the second storm. The report indicates that this was the pattern followed by the tropical storms of 1955. A unit hydrograph was applied to the runoff to determine the inflow into the reservoir. This produced a double-peaked hydrograph with peak flow values of 18,300 cubic feet per second (cfs). The design storm precipitation was not reported. It is reported that the routing of the flood hydrograph through the reservoir produced a maximum lake level of five feet above the emergency spillway crest (Elevation 1440.5) (Plate 12). The maximum spillway outflow during the design storm is reported to be 3800 cfs.

The maximum discharge capacity of the outlet works is reported to be 890 cfs when the pool is at the normal pool elevation (Elevation 1427) and 980 cfs when the pool is at the emergency spillway crest level (Elevation 1435.5).

(2) Embankment. The embankment design was apparently based on the geology and the soils report prepared by Berger and Associates, Inc. However, as noted above, the data on the design of the embankment were not available for review. The Berger report indicates that the material for the dam predominantly consists of silty clay or clayey silt with liquid limits ranging from 28 percent to 30 percent and plastic limits ranging between 21 and 23 percent. Maximum dry density for the borrow material obtained from standard compaction tests were reported to be in the range of 111.5 to 117.5 pounds per cubic foot (pcf). Permeability for the borrow material was 10^{-8} cm/sec. The shear strength of the embankment material was reported to be in the range of 1200 to 2000 pounds per square foot (psf).

(3) Appurtenant Structures. There are no design calculations available for the appurtenant structures.

2.2 Construction. The construction of the dam was apparently conducted in accordance with the drawings and specifications as prepared by Gannett Fleming Corddry & Carpenter, Inc. No reference was found to indicate that any unusual problems were encountered during construction of the dam.

2.3 Operation. The superintendent of the state park reported that no formal operating procedures for the dam exist. The lake is normally maintained at primary spillway sill level and inflow occurring when the pool level is at or above the primary spillway level is discharged through the primary spillway. During low flow conditions, the flow in Beaverdam Run downstream from the reservoir is maintained by the flow through the eight-inch low flow gate.

2.4 Other Investigations. None reported.

2.5 Evaluation

a. Availability. Available data were provided by PennDER.

b. Adequacy

(1) Hydrology and Hydraulics. The reported results of the hydrology and hydraulics analysis are not considered to be adequate to assess the conformity of the analysis to the current spillway design criteria.

(2) Embankment. Review of the geotechnical aspects of the design indicates that the design generally followed the accepted practice for subsurface investigation and laboratory testing applicable at the time of design. No information was available on the stability and seepage analyses for the dam.

(3) Appurtenant Structures. Review of the design drawings indicates that, as designed, no significant design deficiencies exist that should affect the overall performance of the appurtenant structures.

c. Operating Records. It was reported that operating records for the dam consist of monthly lake level readings. The lake level is also continuously monitored by the U.S. Geological Survey (USGS). A review of USGS records indicates that the record high water level (Elevation 1431.63) in the reservoir occurred during Tropical Storm Agnes on July 24, 1972. Peak discharge through the primary spillway was 900 cfs.

d. Post-Construction Changes. After the first filling of the lake, the normal pool level was raised about one foot by construction of a sill across the primary spillway entrance.

e. Seismic Stability. The dam is located in Seismic Zone 1, and based on visual observations, the static stability of the dam is considered to be adequate. Therefore, based on the recommended criteria for evaluation of seismic stability of dams, the structure is assumed to present no hazard from earthquakes.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The on-site inspection of the Glendale Dam consisted of:

1. Visual inspection of the embankment, abutments, and embankment toe.

2. Visual examination of the spillway and its components, the downstream end of the outlet pipe, and other appurtenant features.

3. Observation of factors affecting the runoff potential of the drainage basin.

4. Evaluation of downstream area hazard potential.

The specific observations are illustrated in Plate 13 and in the photographs in Appendix C.

b. Embankment. The general inspection of the embankment consisted of searching for indications of structural distress, such as cracks, subsidence, bulging, wet areas, seeps and boils, and observing general maintenance conditions, vegetative cover, erosion, and other surficial features.

In general, the condition of the dam is considered to be good. Only one significant seepage area was found. This seepage was located at the junction of the embankment and the left abutment at the toe level of the dam. The seepage contained acid mine drainage and the flow was estimated to be in the range of 15 to 20 gallons per minute (gpm). Swampy areas were located along the toe of the dam. However, no flow was observed from these areas. A minor seepage was located on the right side of the spillway plunge pool, flowing approximately one to two gpm. Also, no indication of flow was observed from the perched water on the downstream slope bench.

The other condition requiring attention is the high grass on the downstream face of the dam which requires annual mowing.

c. Apppurtenant Structures. The spillway structures, spillway crests, channels, and plunge pools were examined for deterioration or other signs of distress and obstructions that would limit flow. In general, the structures were found to be in good condition. The outlet pipe valve was operated by state park personnel and observed to be functional.

d. Reservoir Area. A map review indicates that the waterhsed is predominantly covered with woodlands.

A review of the regional geology (Appendix E) indicates that the shorelines are not likely to be susceptible to massive landslides which would affect the storage volume of the reservoir or cause overtopping of the dam by displaced water.

e. Downstream Channel. Downstream from the dam, Beaverdam Run meanders through a 1500-foot valley and flows into Clearfield Creek about 1.5 miles downstream from the dam. In this reach, Beaverdam Run is 40 to 50 feet wide and at bankful stage is 4 to 5 feet deep. The 1958 engineer's report indicates that bankful capacity of Beaverdam Run is 400 cfs.

3.2 Evaluation. The condition of the dam is considered to be good. The outlet pipe was half full due to the backwater from the stream. Therefore, the outlet pipe was not inspected. The acid mine drainage observed at the junction of the embankment and the left abutment at toe level is not considered to affect the overall performance of the dam at this time. However, this seepage should be monitored and recorded to determine that the flow is not increasing with time. The turbidity of the seepage should also be observed.

The grass on the downstream slope requires annual mowing.

The operation of the outlet pipe sluice gate was observed and found to be functional.

SECTION 4
OPERATIONAL FEATURES

4.1 Procedure. State park personnel reported that there are no formal operating procedures for the dam. Inflow into the reservoir is discharged through the uncontrolled primary spillway.

One operational feature of the dam which may affect safety is the outlet pipe gate, if it is required to lower the reservoir.

4.2 Maintenance of the Dam. The general maintenance of the dam is considered to be satisfactory. However, acid mine drainage seepage flows should be monitored and recorded to determine that the rate of flow is not increasing with time. Grass on the embankment and below the toe should be annually mowed to facilitate inspection of these areas.

4.3 Maintenance of Operating Facilities. The maintenance condition of the operating facilities is considered to be satisfactory. The outlet conduit sluice gate was operated and observed to be functional.

4.4 Warning System. No formal warning system exists for the dam. The park superintendent, responsible for the operation of the dam, resides in the park area. Telephone and radio communication facilities are available at the park office.

4.5 Evaluation. The dam is satisfactorily maintained. However, seepage flow records should be maintained. Grass on the embankment and on the area below the toe should be annually mowed to facilitate adequate inspection of these areas.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. Glendale Dam has a watershed of 41.9 square miles and impounds a reservoir with a surface area of 1600 acres at normal pool level. The combined primary and emergency spillway is located on the right abutment. From the spillway rating curve included in the design drawings, the combined capacity of the spillways was determined to be 9800 cfs with no freeboard.

b. Experience Data. As previously stated, Glendale Dam is classified as an "intermediate" dam in the "high" hazard category. Under the recommended criteria for evaluating emergency spillway discharge capacity, such impoundments are required to pass the PMF.

The adequacy of the spillway was analyzed based on the simplified procedure and the hydrologic data provided by the Baltimore District, Corps of Engineers (Appendix D). The Corps of Engineers reported that peak of PMF inflow hydrograph for a 38 square mile watershed in Chest Creek was determined to be 64,800 cfs. These data were transposed to the Glendale watershed and the PMF inflow hydrograph was determined to have a peak flow of 70,100 cfs and a total volume of 58,100 acre-feet. Further analysis according to the procedure indicates that the spillway can pass 85 percent of PMF without overtopping. In the event of full PMF, it is calculated that the dam would be overtopped by 0.3 foot.

c. Visual Observations. On the date of inspection, no conditions were observed that would indicate that the emergency spillway of the dam could not function satisfactorily in the event of a flood.

d. Overtopping Potential. As stated above, the spillway can pass 85 percent of PMF without overtopping.

e. Spillway Adequacy. The spillway is classified to be inadequate (85 percent PMF). However, it is not considered to be seriously inadequate since the capacity exceeds 50 percent PMF.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

(1) Embankment. As discussed in Section 3, the field observations did not reveal any signs of distress that would significantly affect the short-term stability of the dam and no unsatisfactory conditions were reported in the past.

(2) Appurtenant Structures. Structural performance of the appurtenant structures is considered to be satisfactory.

b. Design and Construction Data.

(1) Embankment. The dam was apparently designed based on the evaluation of subsurface conditions and results of laboratory tests. Although data on the subsurface investigation and soils testing were available, no information was found on the stability and seepage analysis for the dam.

(2) Appurtenant Structures. Review of the design drawings indicates that there are no apparent structural deficiencies that would significantly affect the performance of appurtenant structures.

c. Operating Records. The structural stability of the dam is not considered to be affected by the operational features of the dam.

d. Post-Construction Changes. There have been no reported modifications to the original design that would affect the structural stability of the embankment.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Assessment. The visual observations indicate that the Glendale Dam is in good condition. However, the acid mine drainge on the left abutment should be monitored to document that the rate of seepage is not increasing. It appears that the dam was constructed with reasonable care and the design generally followed the accepted engineering practices at the time of design.

The capacity of the spillway was found to be "inadequate" (85 percent PMF). However, it is not considered to be "seriously inadequate" because the spillway capacity is in excess of 50 percent PMF.

b. Adequacy of Information. The available information in conjunction with visual observations and the previous experience of the inspectors are considered to be sufficient to make a reasonable assessment of the condition of the dam.

c. Urgency. The following recommendations should be considered immediately or on a continued basis.

d. Necessity for Further Investigation. The condition of the dam is not considered to require further investigation at this time.

7.2 Recommendations/Remedial Measures

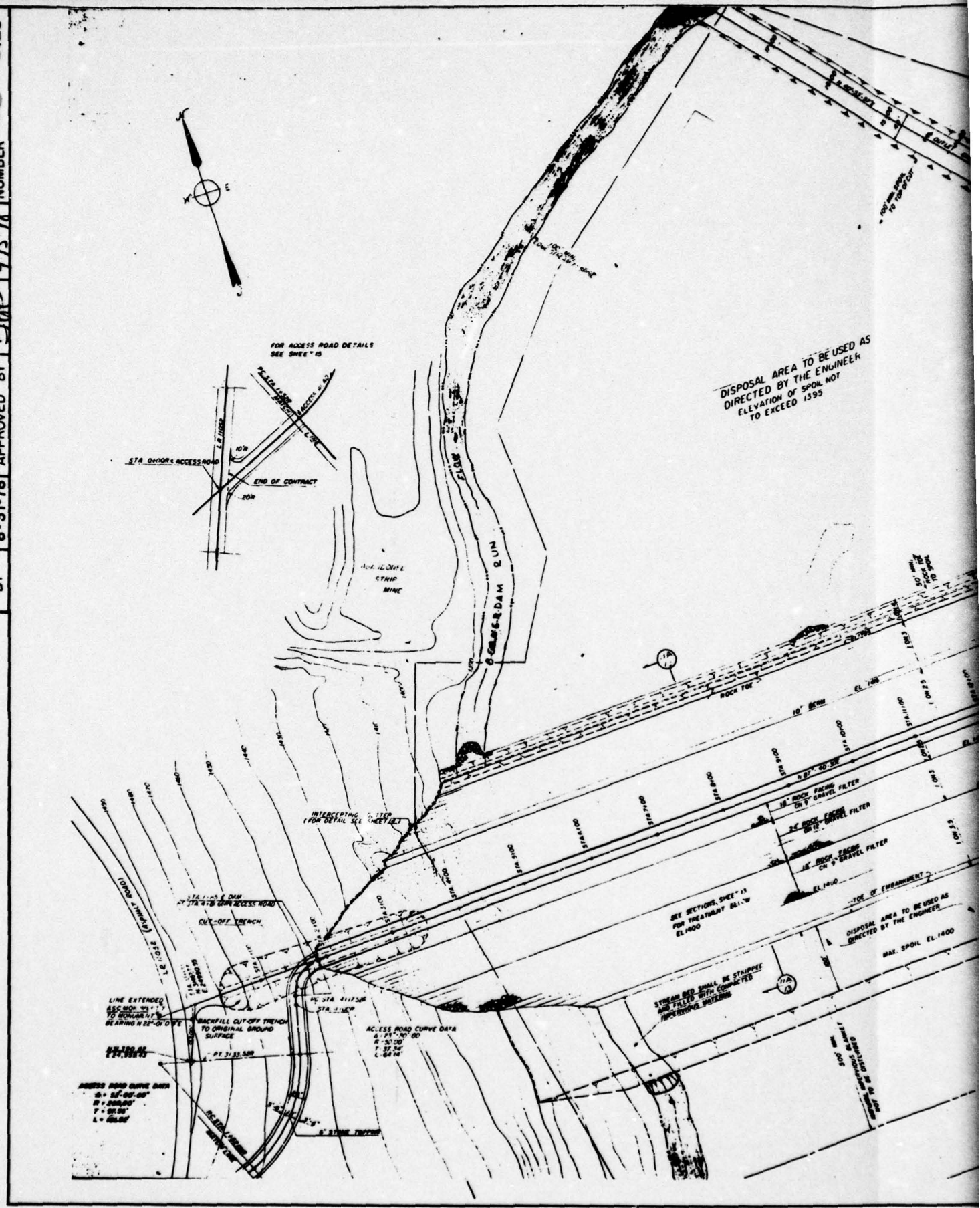
1. It is recommended that the quantity and turbidity of seepage on the left abutment should be monitored and recorded. If conditions degrade, a detailed study should be made and necessary remedial measures taken.

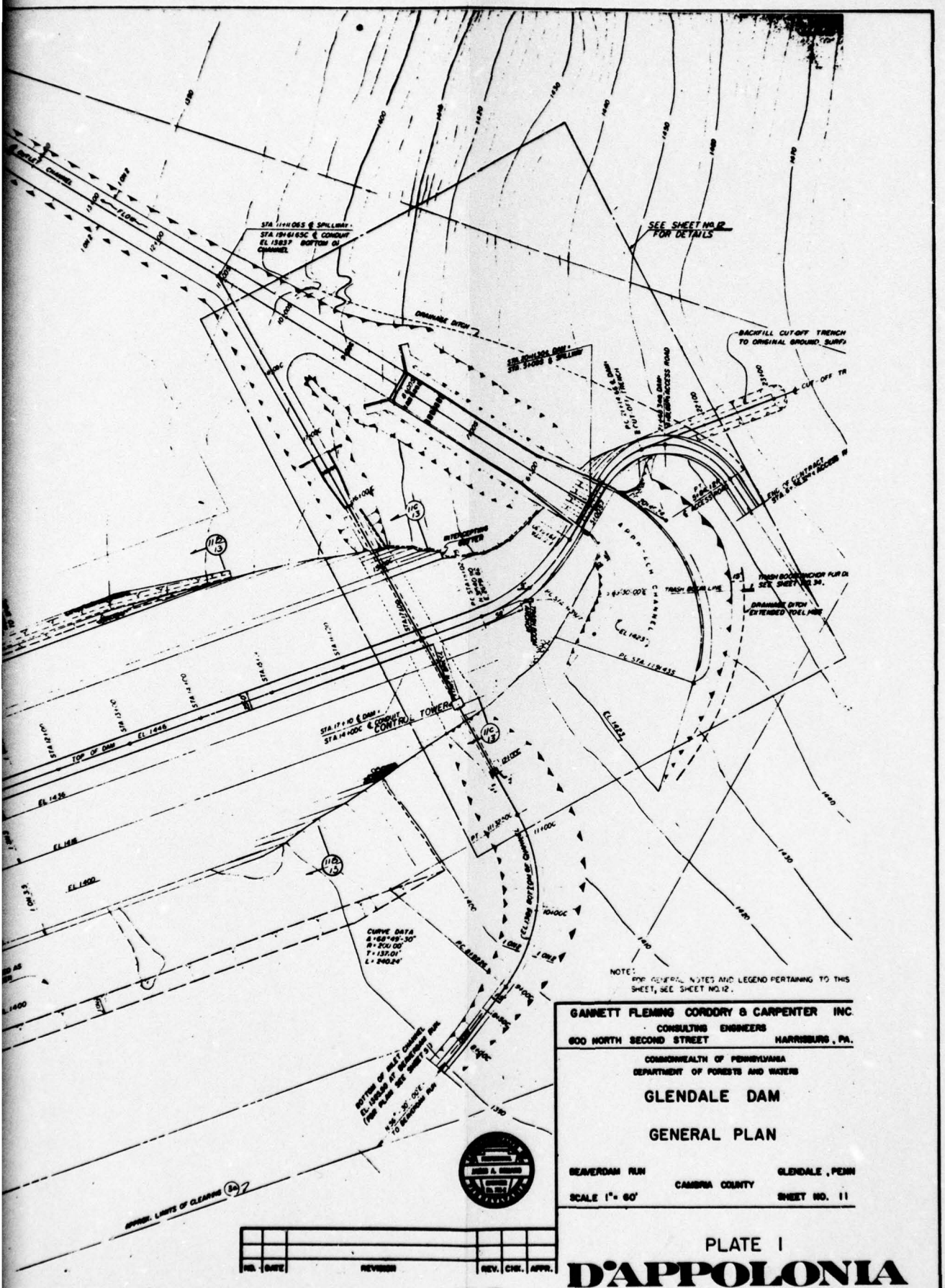
2. High grass on the embankment and the toe area should be mowed at least annually to facilitate future inspections.

3. It is recommended that the owner provide around-the-clock surveillance during unusually heavy runoff and develop a formal warning system to alert the downstream residents in the event of an emergency.

PLATES

DRAWN BY	DJD	CHECKED BY	BE	9-15-78	DRAWING NUMBER	78-4-B128
	8-31-78	APPROVED BY	JHP	9/15/78		





GANNETT FLEMING CORDDRY & CARPENTER INC.
CONSULTING ENGINEERS
600 NORTH SECOND STREET HARRISBURG, PA.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

GLENDALE DAM

GENERAL PLAN

BEAVERDAM RUN — GLENDALE, PENN
CAMBRIA COUNTY
SCALE 1" = 60' — SHEET NO. 11

NO.	DATE	REVISION	REV.	CHK.	APPR.

PLATE I

D'APPOLONIA

1

2

DRAWN BY	trs	CHECKED BY	GE	9-15-78	DRAWING 7 14-B194
9-5-78		APPROVED BY	JWS	9.15.78	NUMBER

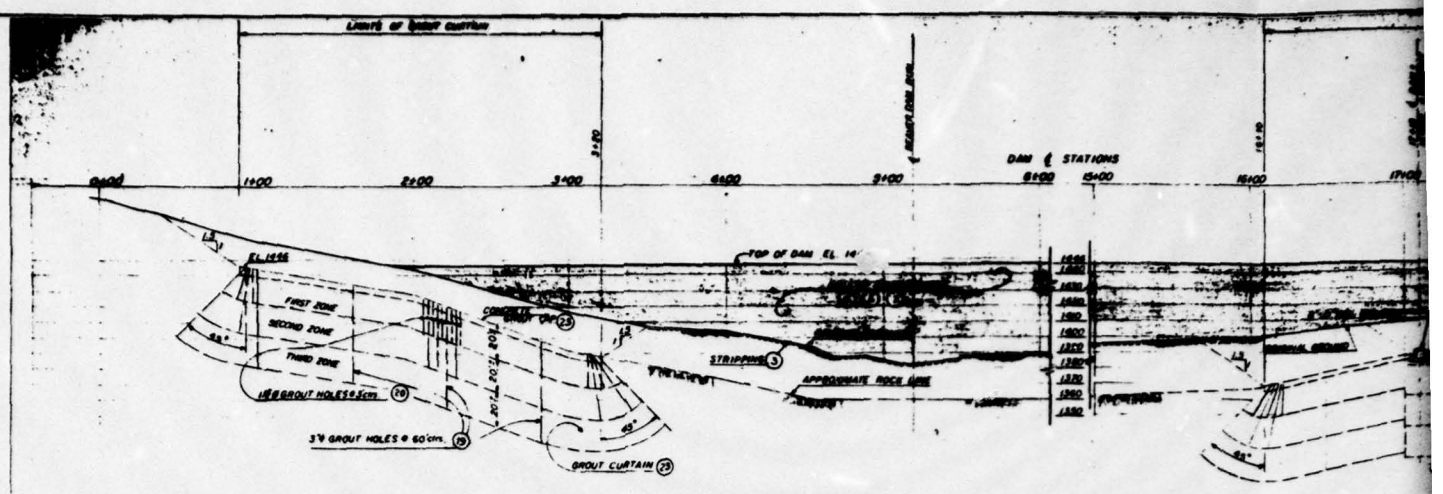
REFERENCE:

U.S.G.S. 7.5' ALTOONA (1972), ASHVILLE (1972), CARROLLTOWN (1972), BLANDBURG (1972), COALPORT (1972), AND HASTING (1972), PA. QUADRANGLES, SCALE 1: 24000

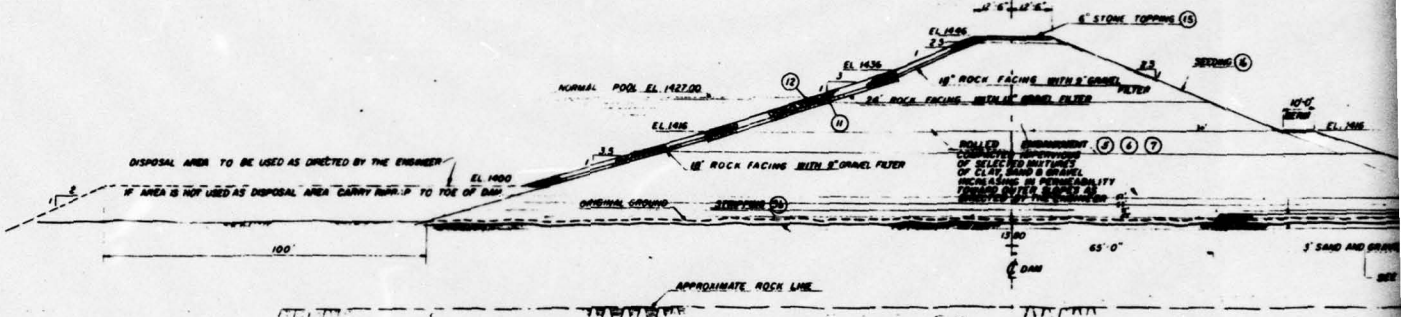
PLATE 2

D'APPOLONIA

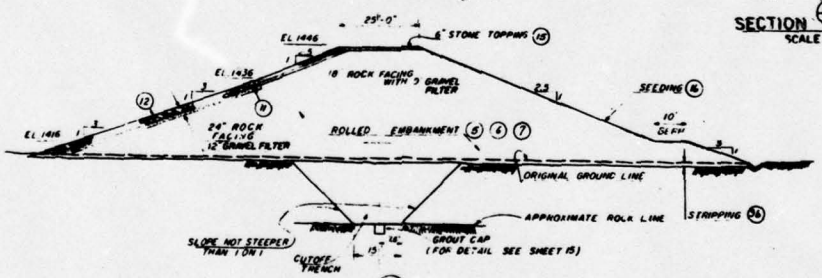
DRAWN BY	DJD	CHECKED BY	BE	9-15-78	DRAWING NUMBER	78-4-B137
	8-31-78	APPROVED BY	[illegible]	G.I.S 78		



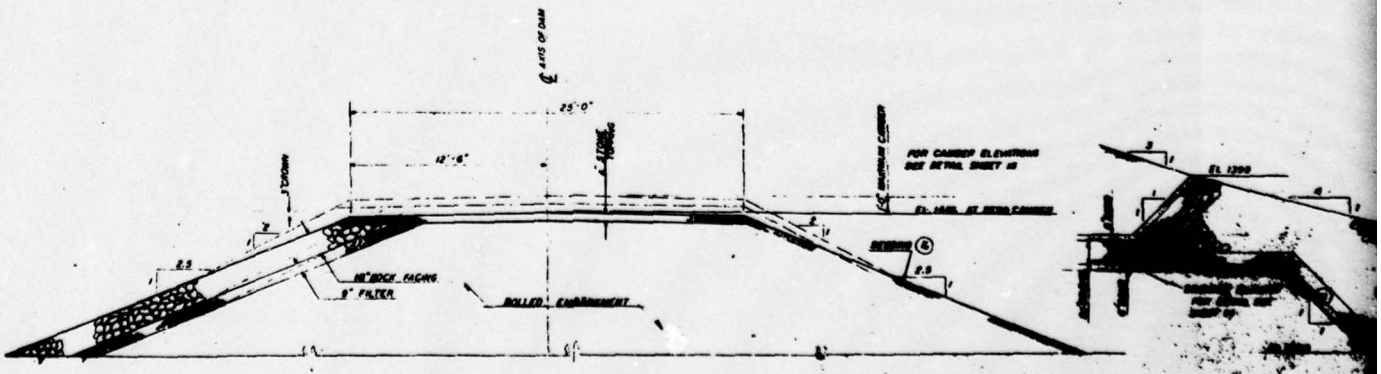
PROFILE ALONG ℄ OF DAM
SCALE 1" = 40'



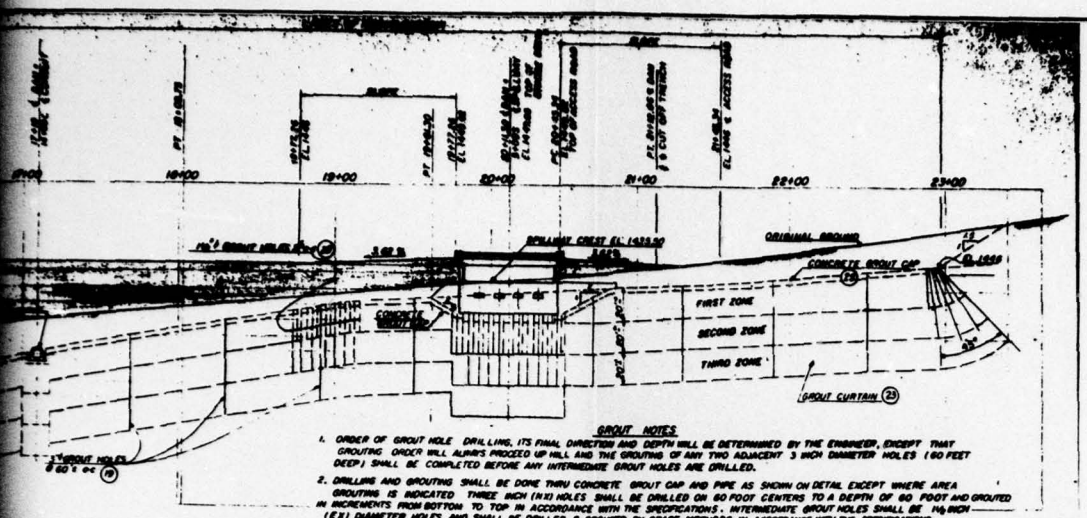
SECTION
SCALE 1" = 20'



SECTION
SCALE 1" = 20'

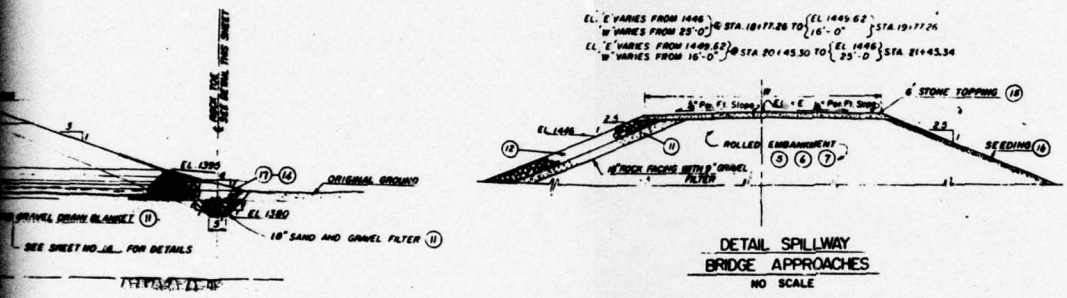


DETAIL - TOP OF DAM
SCALE 1/4" = 1'-0"

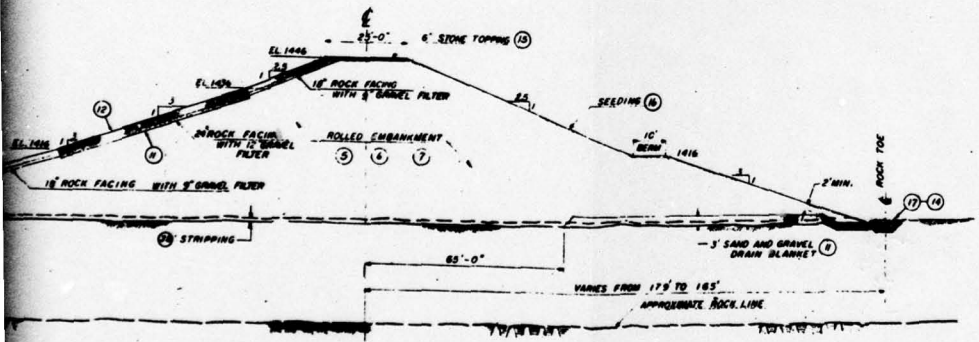


GROUT NOTES

1. ORDER OF GROUT HOLE DRILLING, ITS FINAL DIRECTION AND DEPTH WILL BE DETERMINED BY THE ENGINEER, EXCEPT THAT GROUTING ORDER WILL ALWAYS PROCEED UP HILL AND THE GROUTING OF ANY TWO ADJACENT 3 INCH DIAMETER HOLES (60 FEET DEEP) SHALL BE COMPLETED BEFORE ANY INTERMEDIATE GROUT HOLES ARE DRILLED.
2. DRILLING AND GROUTING SHALL BE DONE THRU CONCRETE GROUT CAP AND PIPE AS SHOWN ON DETAIL EXCEPT WHERE AREA GROUTING IS INDICATED. THREE INCH (3") HOLES SHALL BE DRILLED ON 60 FOOT CENTERS TO A DEPTH OF 60 FOOT AND GROUTED IN INCREMENTS FROM BOTTOM TO TOP IN ACCORDANCE WITH THE SPECIFICATIONS. INTERMEDIATE GROUT HOLES SHALL BE 1½ INCH (1½") DIAMETER HOLES AND SHALL BE DRILLED & GROUTED BY STAGE METHODS IN ACCORDANCE WITH THE SPECIFICATIONS.



DETAIL SPILLWAY
BRIDGE APPROACHES
NO SCALE



SECTION (18)
SCALE 1"=20'

NOTE: FOR GENERAL NOTES PERTAINING TO THIS SHEET, SEE SHEET NO. 12.

GANNETT FLEMING CORDDRY & CARPENTER INC
CONSULTING ENGINEERS
600 NORTH SECOND STREET HARRISBURG, PA

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

GLENDALE DAM

EMBANKMENT

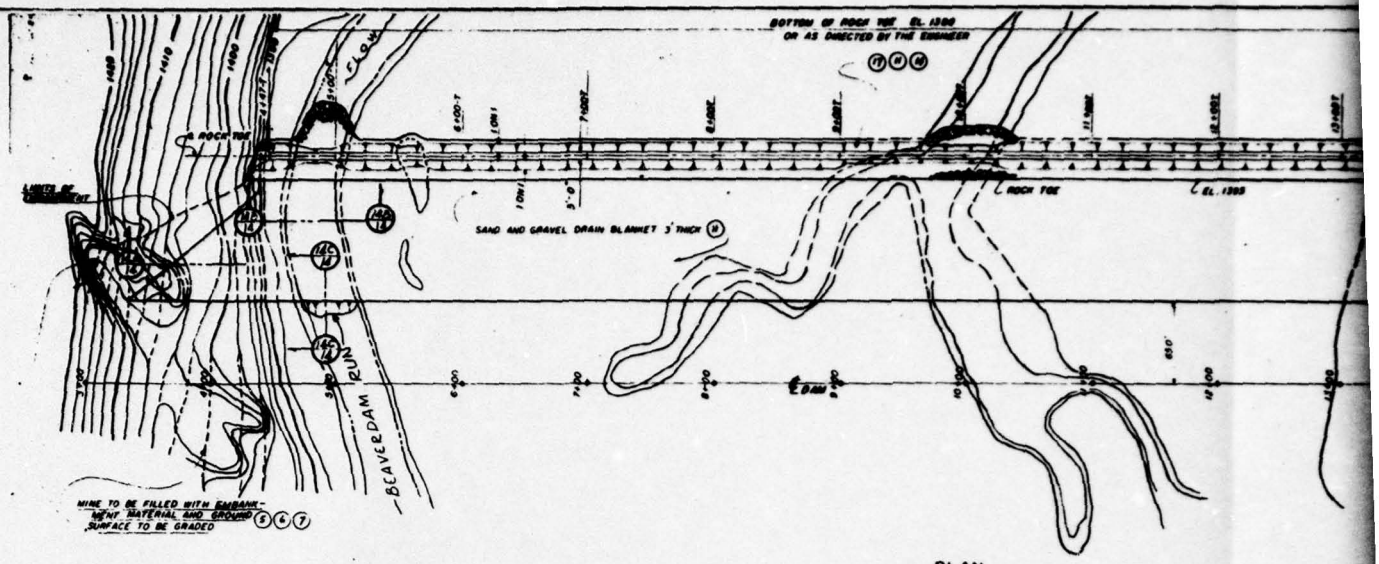
SECTIONS & DETAILS

SHAWVERDAM RUN GLENDALE, PENN
CAMBRIA COUNTY
TOWNSHIP AS SHOWN SCALE AS SHOWN

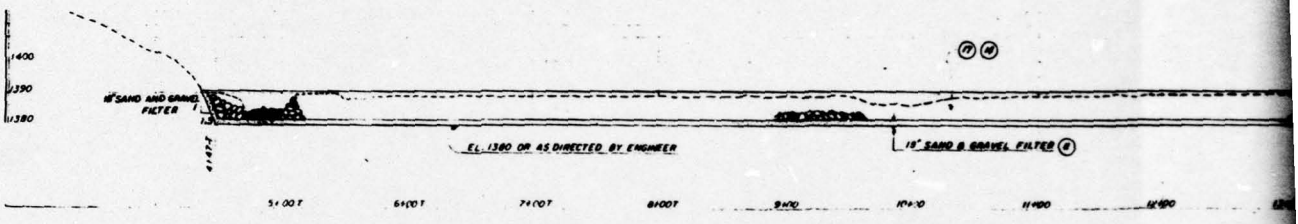
PLATE 3

D'APPOLONIA

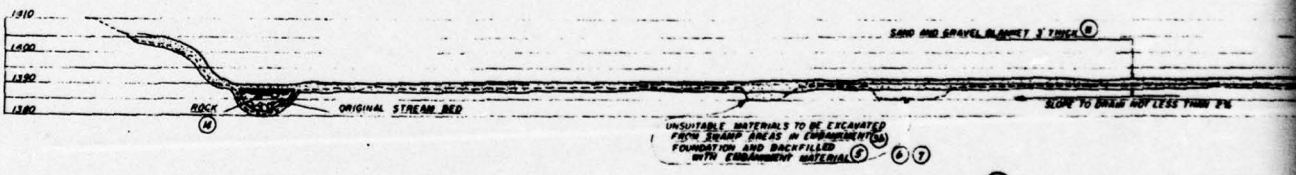
DRAWN BY	DJD	CHECKED BY	BE	9.15.78	DRAWING NUMBER	78-14-B135
	8-31-78	APPROVED BY				



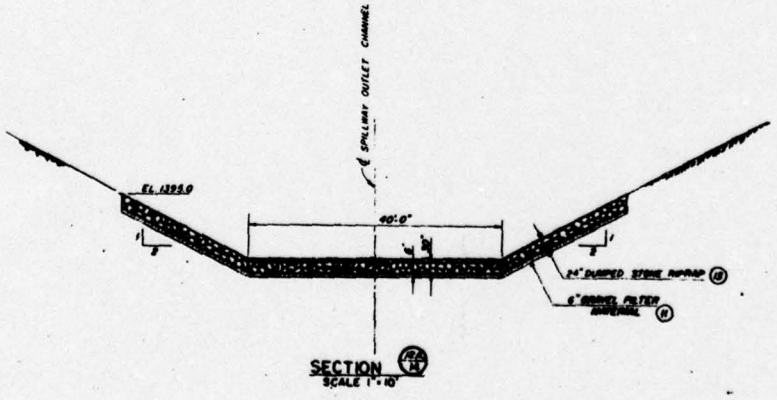
PLAN
DRAINAGE BLANKET & ROCK TOE
SCALE 1" = 50'



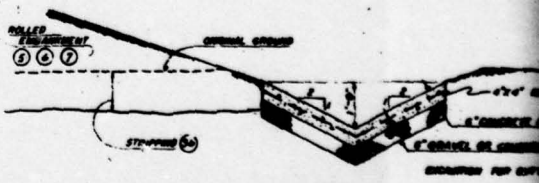
PROFILE ALONG ℄ ROCK TOE
HORIZ. SCALE 1" = 50'
VERT SCALE 1" = 20'



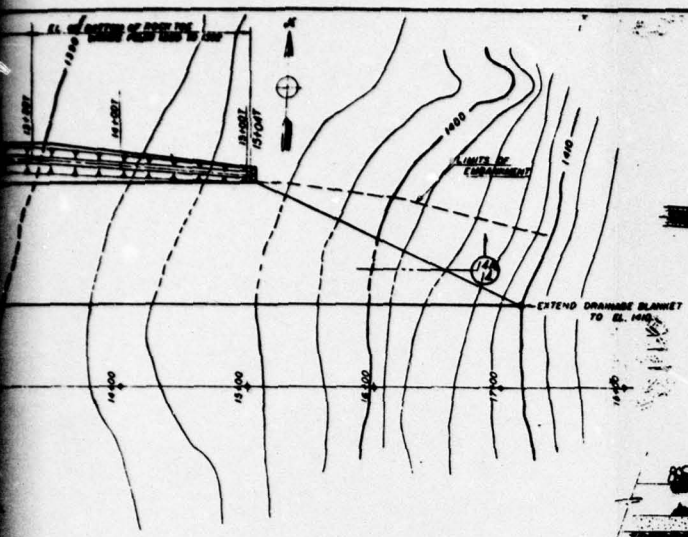
SECTION
HORIZ SCALE 1" = 50'
VERT. SCALE 1" = 20'

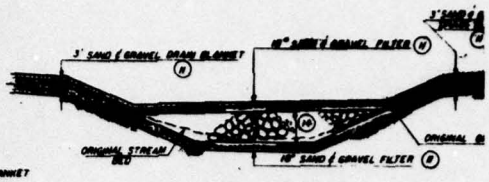


SECTION
SCALE 1" = 10'

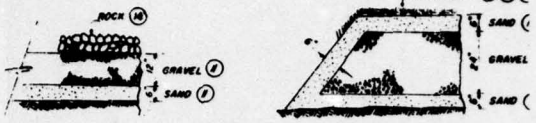


DETAIL
INTERCEPTING GUTTER
NO SCALE



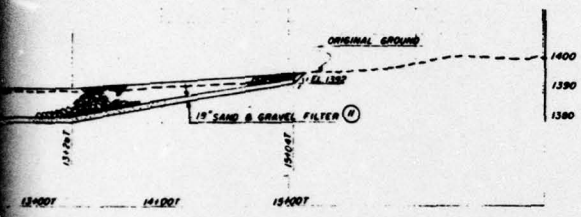


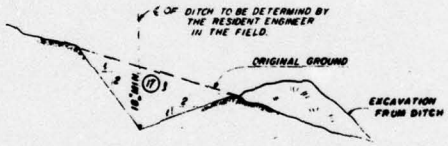
SECTION (14c/14)
SCALE 1"=10'



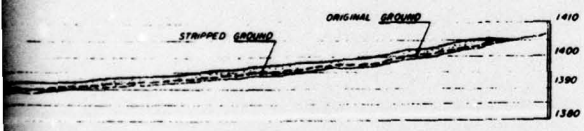
NOTE:
GRAVEL SHALL CONSIST OF EQUAL PARTS OF NO. 2 P AND NO. 4 COARSE AGGREGATES IN SPECIFICATIONS OF THE PENNA. DEPT. OF HIGHWAYS; SAND SHALL MEET ALL REQUIREMENTS OF TYPE A FINE AGGREGATE IN SPECIFICATIONS OF PENNA. DEPT. OF HIGHWAYS.

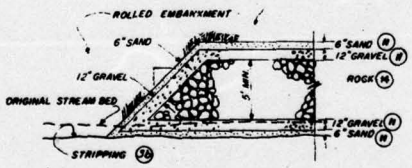
TYPICAL SAND & GRAVEL FILTERS
SCALE 1/2"=1'-0"





DRAINAGE DITCH DETAIL
NO SCALE





SECTION (14c/14)
SCALE 3/16"=1'-0"

NOTE: FOR GENERAL NOTES PERTAINING TO THIS SHEET, SEE SHEET NO. 12

GANNETT FLEMING CORDDRY & CARPENTER INC
CONSULTING ENGINEERS
600 NORTH SECOND STREET HARRISBURG, PA

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

GLENDALE DAM

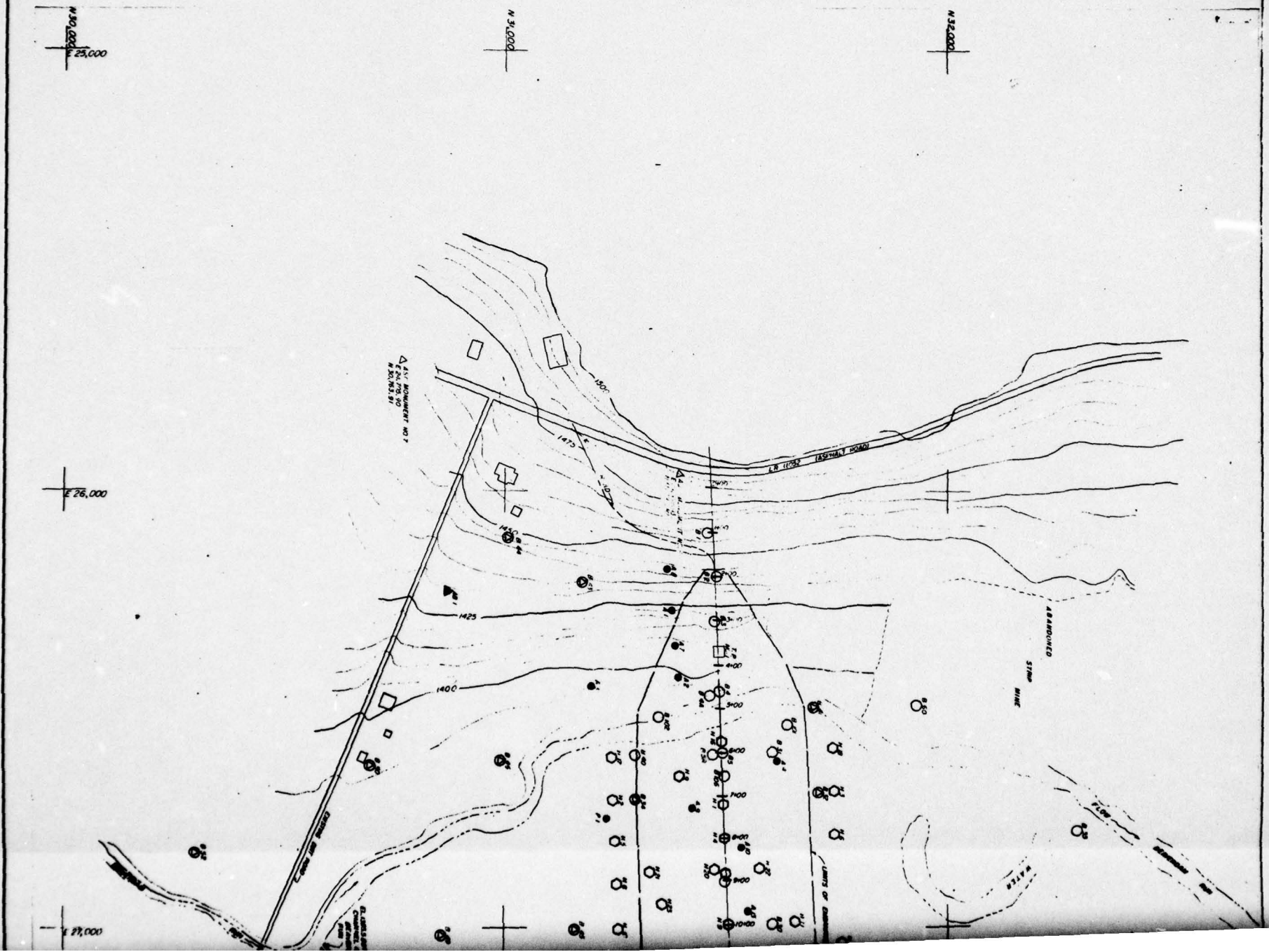
EMBANKMENT DRAINAGE DETAILS

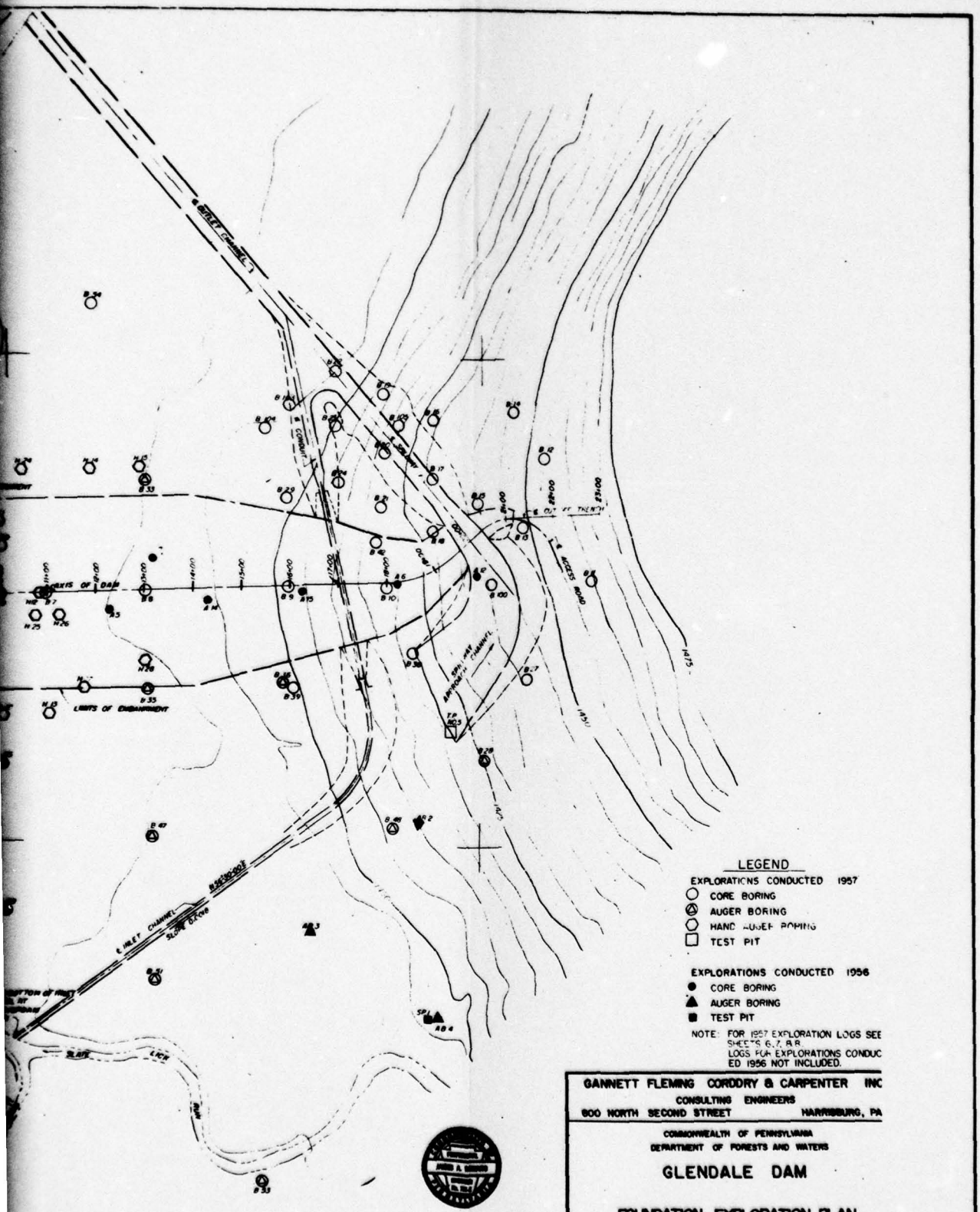
BEAVERDAM RUN GLENDALE, PENN
CAMBRIA COUNTY
SCALE AS SHOWN SHEET NO. 14

PLATE 4

D'APPOLONIA

DRAWN BY	DJD	CHECKED BY	BF	9-15-78	DRAWING NUMBER	7[illegible]14-B129
	8-31-78	APPROVED BY	JRP	9.15.78		





LEGEND

EXPLORATIONS CONDUCTED 1957

- CORE BORING
- AUGER BORING
- HAND AUGER BORING
- TEST PIT

EXPLORATIONS CONDUCTED 1956

- CORE BORING
- AUGER BORING
- TEST PIT

NOTE: FOR 1957 EXPLORATION LOGS SEE SHEETS 6, 7, 8, 8
LOGS FOR EXPLORATIONS CONDUCTED 1956 NOT INCLUDED.

GANNETT FLEMING CORDDRY & CARPENTER INC
CONSULTING ENGINEERS
800 NORTH SECOND STREET HARRISBURG, PA

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

GLENDALE DAM

FOUNDATION EXPLORATION PLAN

BEAVERDAM RUN CAMBRIA COUNTY GLENDALE, PENN

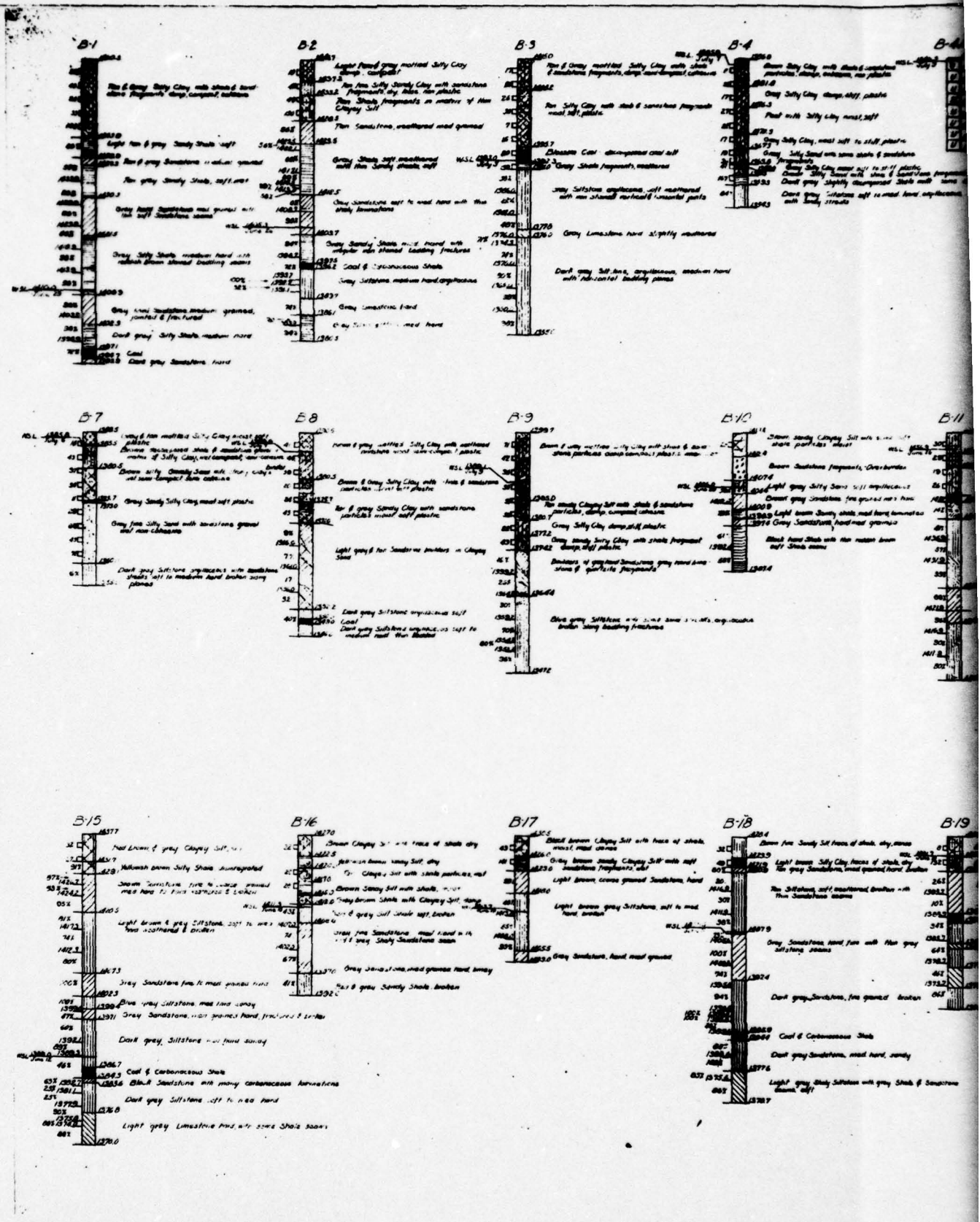
SCALE 1" = 100' SHEET NO. 5

NO.	DATE	REVISION	BR.	APPR.

PLATE 5

D'APPOLONIA

DRAWN BY	DJD	CHECKED BY	BE	8-13-78	DRAWING
	8-31-78	APPROVED BY	JHP	9-15-78	NUMBER 78-114-B138



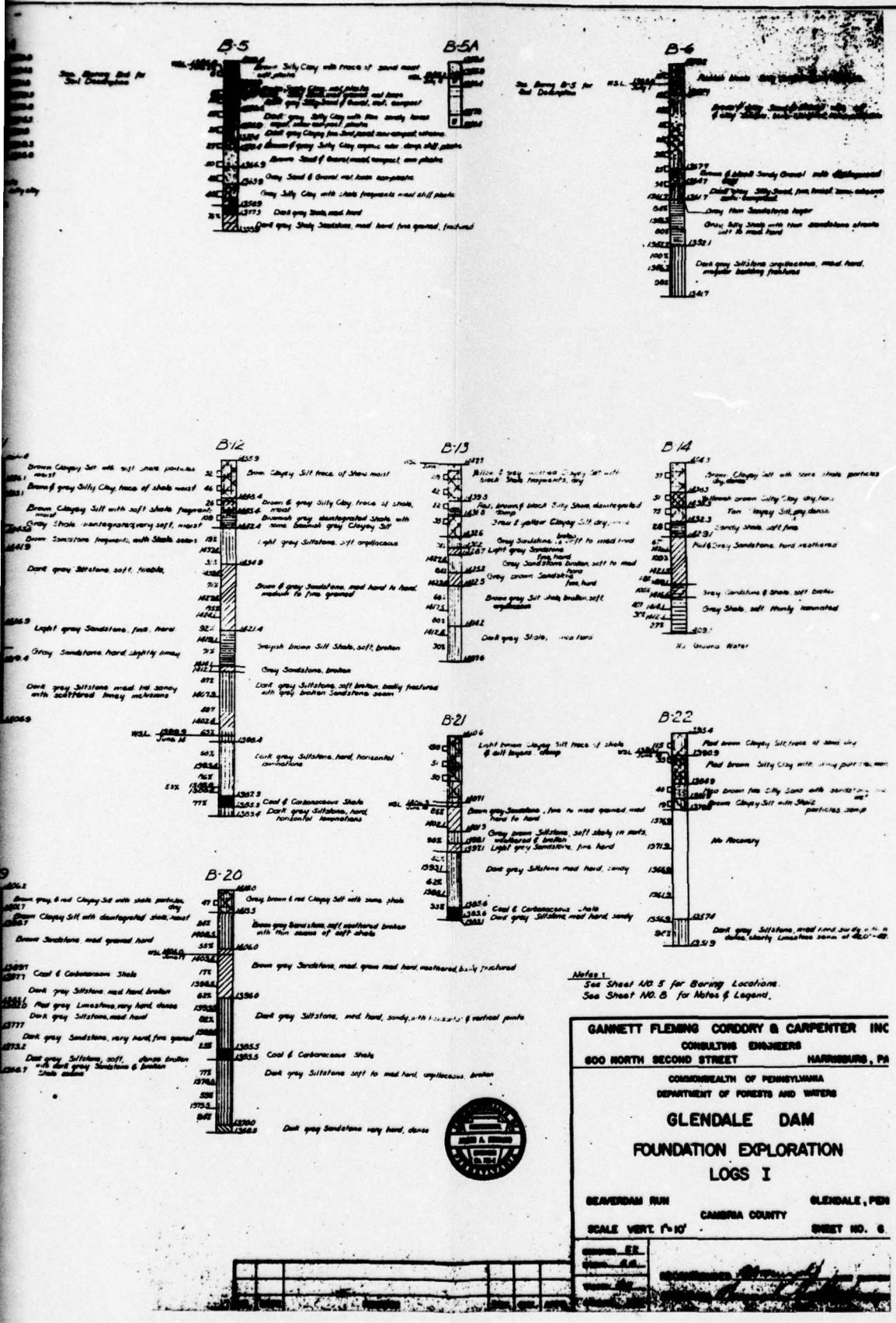
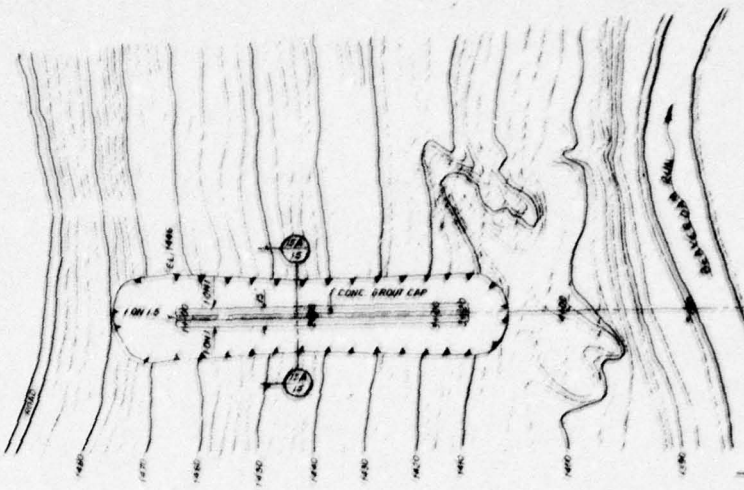
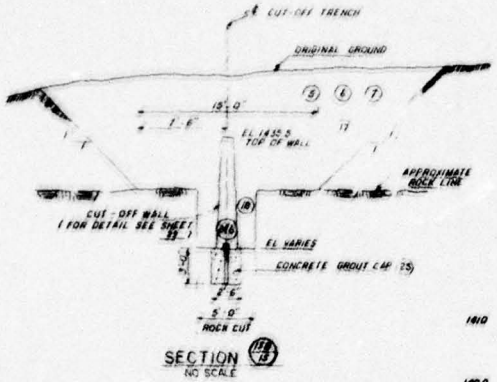


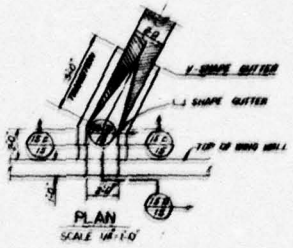
PLATE 6

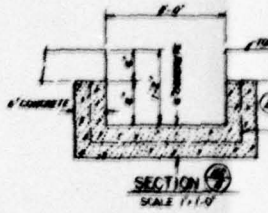
D'APPOLONIA

DRAWN BY	DJD	CHECKED BY		9-15-78	DRAWING NUMBER	78-14-8133
	8-31-78	APPROVED BY				

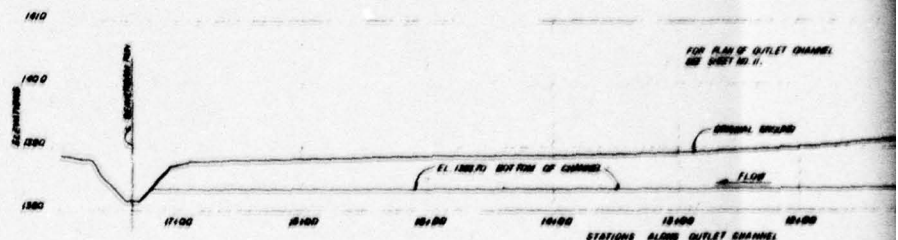




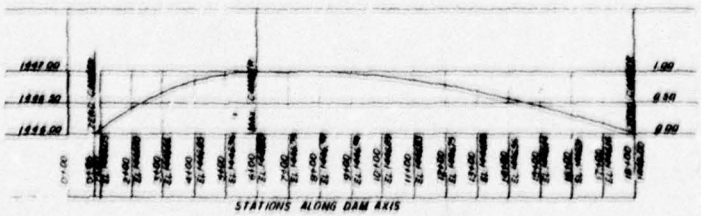




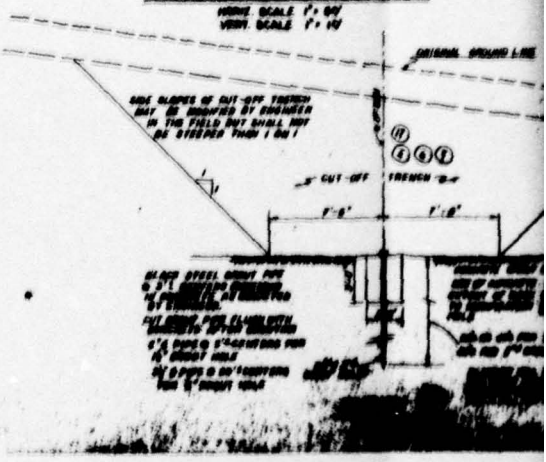
DETAIL - GUTTER OUTLET

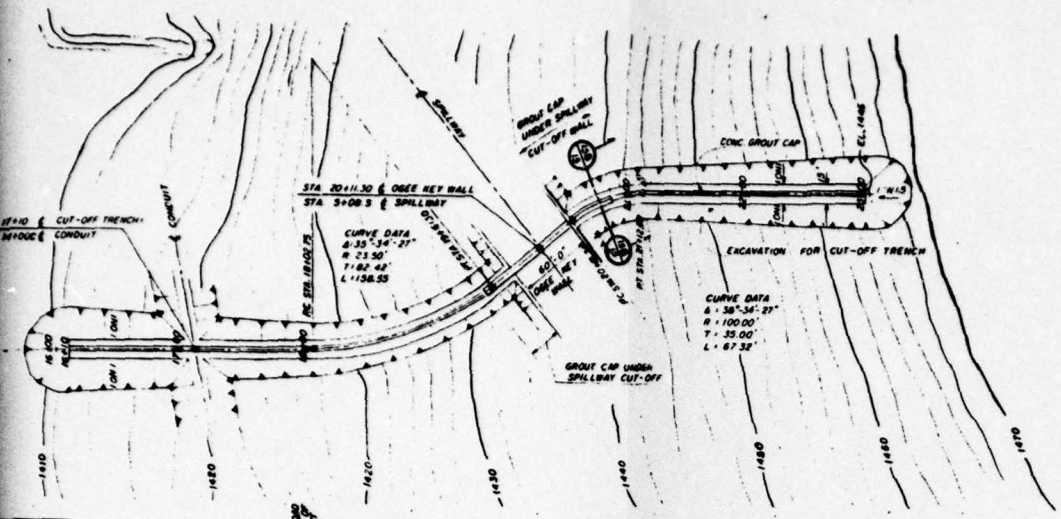


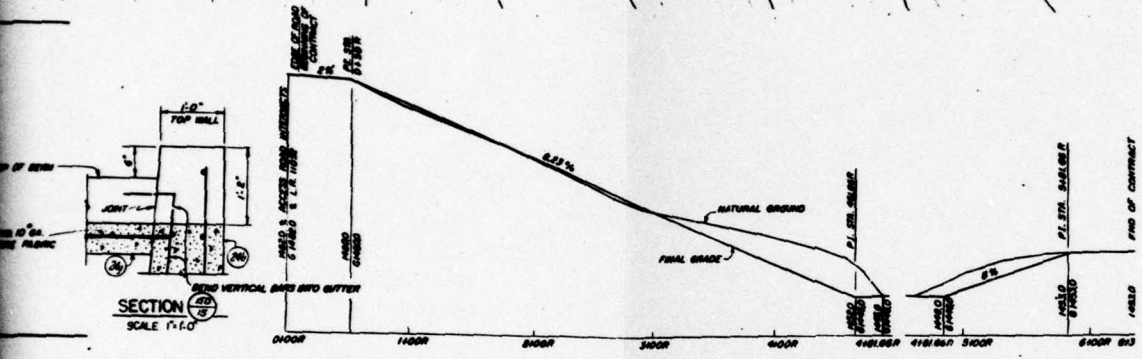
PROFILE - OUTLET CHANNEL

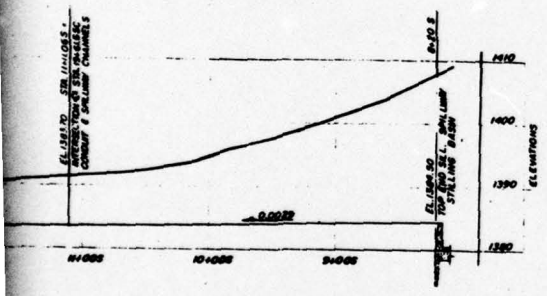


CAMBER AT TOP OF DAM



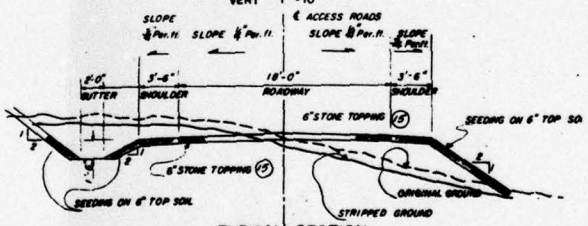






PROFILE - ACCESS ROAD

SCALE HORIZ 1" = 50'
VERT 1" = 10'



TYPICAL SECTION
DAM ACCESS ROADS
NO SCALE

NOTE:
FOR GENERAL NOTES PERTAINING TO THIS SHEET, SEE SHEET NO. 12.

GANNETT FLEMING CORDDRY & CARPENTER INC.
CONSULTING ENGINEERS
600 NORTH SECOND STREET HARRISBURG, PA.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

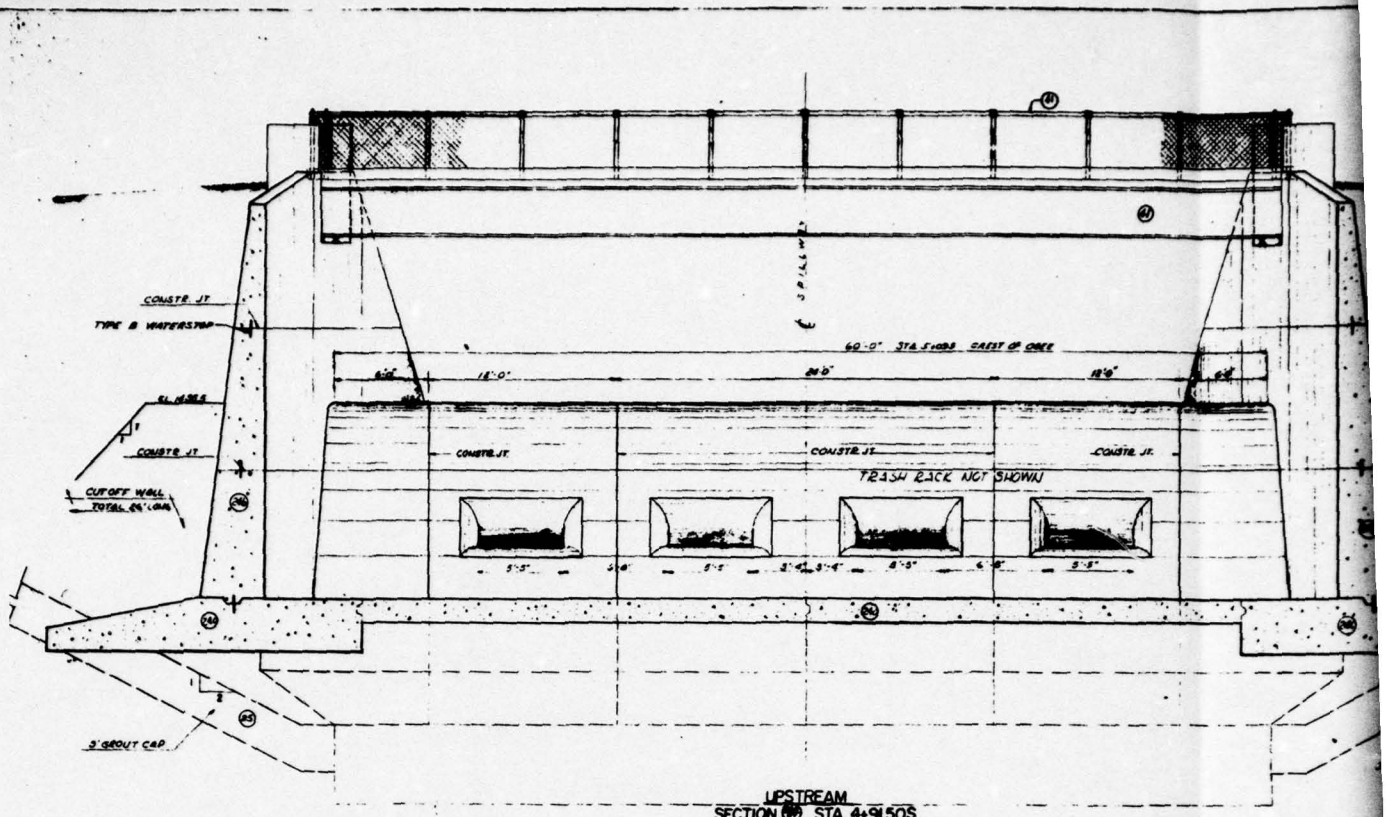
GLENDALE DAM
EMBANKMENT
CUT-OFF TRENCH &
MISCELLANEOUS DETAILS

BEAVERDAM RUN GLENDALE, PENN
COLUMBIA COUNTY
SCALE AS SHOWN SHEET NO. 15

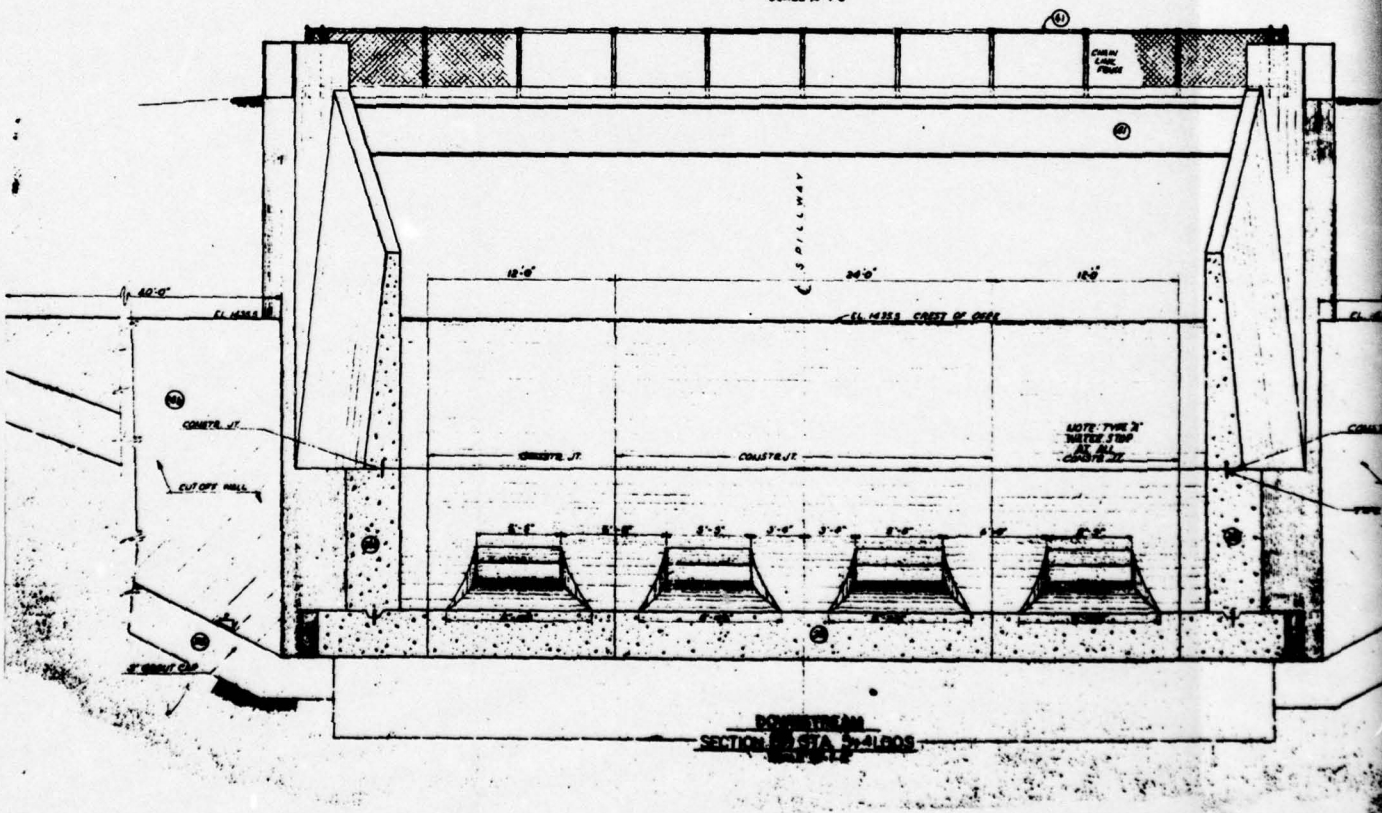
PLATE 7

D'APPOLONIA

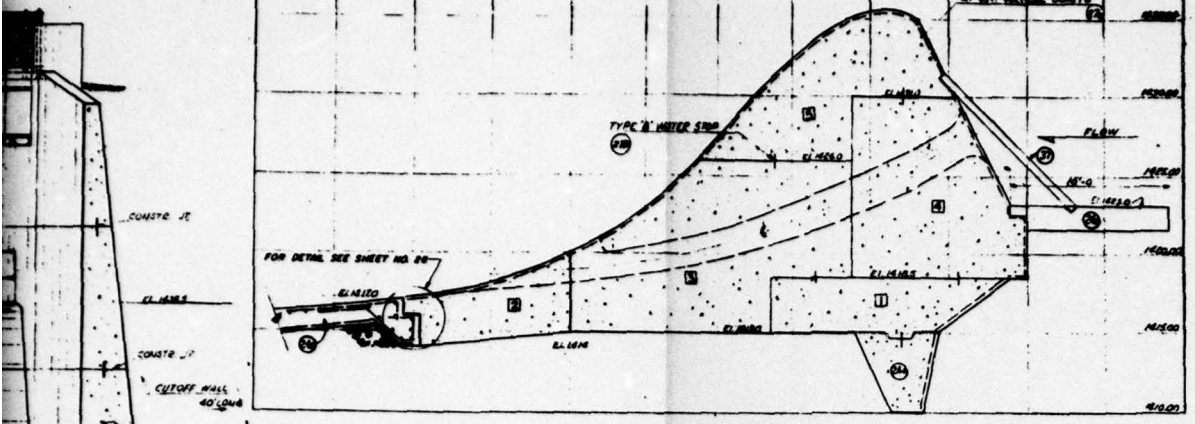
DRAWN BY	CHECKED BY		DRAWING NUMBER
DJD	BE	9-15-78	78-114-B132
8-31-78	APPROVED BY	9.15.78	



UPSTREAM
SECTION @ STA. 4+91.50S
SCALE 1/8"=1'-0"

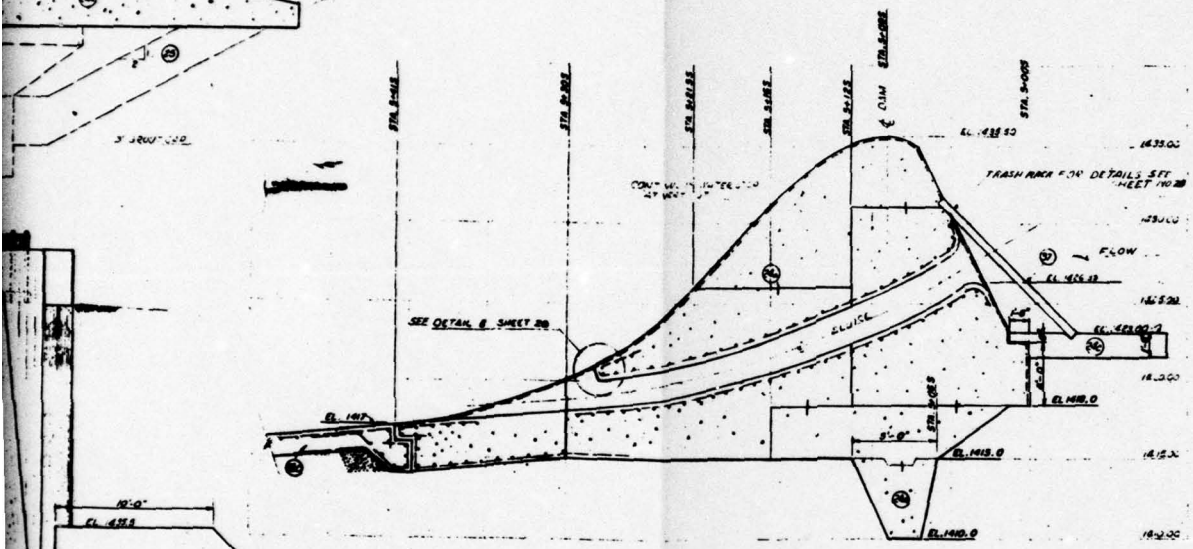


DOWNSTREAM
SECTION @ STA. 5+41.50S



SECTION THRU ℄ OF OGEE
SCALE 3/16"=1'-0"

NOTE: ORDER OF BOURING GIVEN BY 1 - 2 - PAY ITEMS 24



SECTION THRU SLUICE
SCALE 3/16"=1'-0"

NOTE:
FOR GENERAL NOTES PERTAINING TO THIS SHEET, SEE SHEET NO'S. 12 & 16.

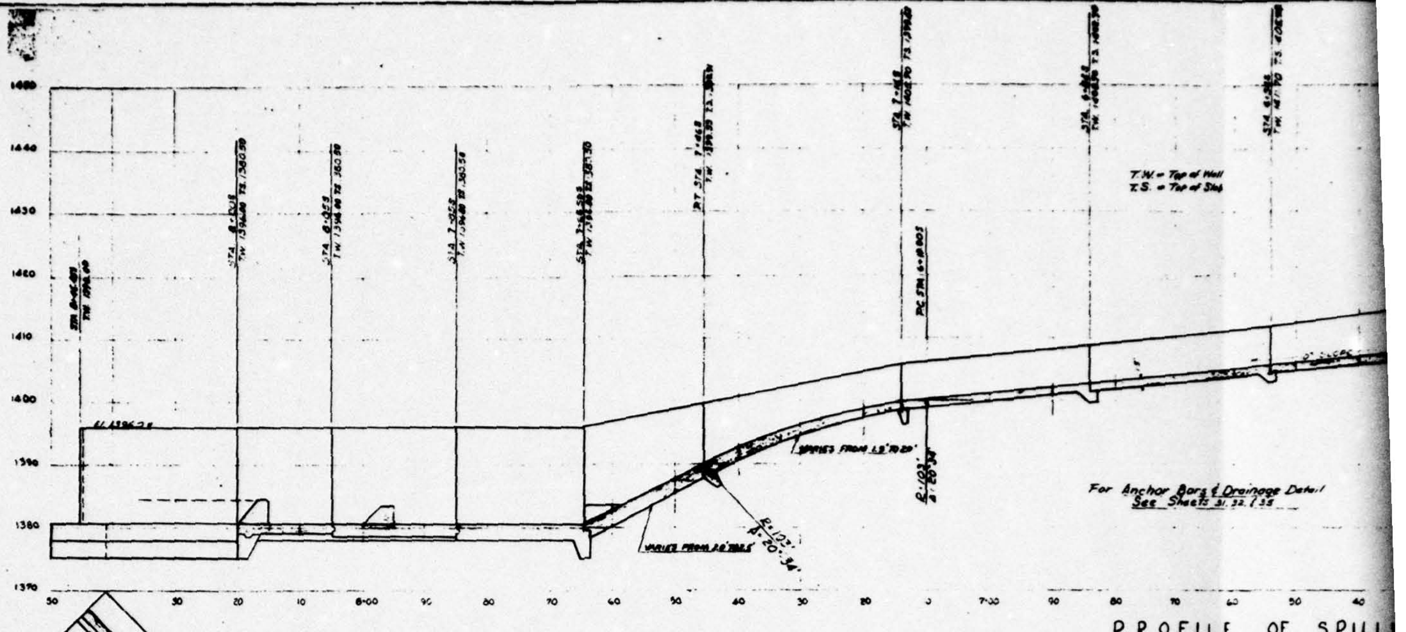
GANNETT FLEMING CORDDRY & CARPENTER INC.
CONSULTING ENGINEERS
600 NORTH SECOND STREET HARRISBURG, PA.
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

GLENDALE DAM
SPILLWAY
OGEE PROFILE

PLATE 8

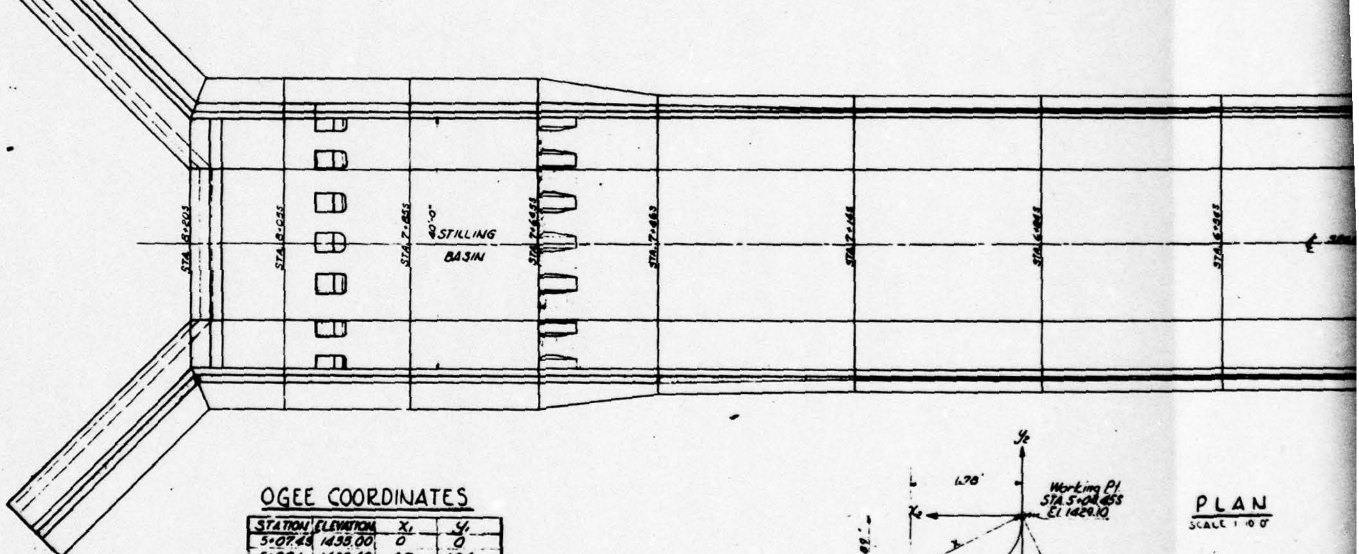
D'APPOLONIA

DRAWN BY	DJD 8-31-78	CHECKED BY	BE 9-15-78	DRAWING NUMBER	76-4-B134
		APPROVED BY	[signature] 9-15-78		



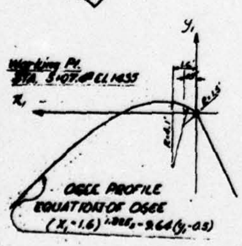
PROFILE OF SPILL[WAY]

SCALE 1"=10'-0"



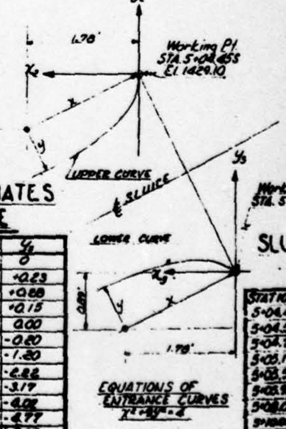
PLAN

SCALE 1"=10'-0"



OGEE COORDINATES

STATION	ELEVATION	X_1	Y_1
5+07.45	1435.00	0	0
5+08.1	1435.40	0.7	+0.4
5+09.0	1435.50	1.6	+0.5
5+10.0	1435.40	2.6	+0.4
5+11.0	1435.13	3.6	+0.13
5+12.0	1434.73	4.6	-0.27
5+13.0	1434.14	5.6	-0.81
5+14.0	1433.53	6.6	-1.47
5+15.0	1432.77	7.6	-2.23
5+16.0	1431.88	8.6	-3.12
5+17.0	1430.84	9.6	-4.16
5+18.0	1429.75	10.6	-5.25
5+19.0	1428.67	11.6	-6.33
5+20.0	1427.38	12.6	-7.42
5+21.0	1426.30	13.6	-8.50
5+22.0	1425.35	14.6	-9.45
5+23.0	1424.67	15.6	-10.33
5+24.0	1423.85	16.6	-11.15
5+25.0	1423.10	17.6	-11.90
5+26.0	1422.40	18.6	-12.60
5+27.0	1421.75	19.6	-13.25
5+28.0	1421.16	20.6	-13.84
5+29.0	1420.60	21.6	-14.40
5+30.0	1420.10	22.6	-14.90
5+31.0	1419.63	23.6	-15.35
5+32.0	1419.21	24.6	-15.79
5+33.0	1418.83	25.6	-16.17
5+34.0	1418.48	26.6	-16.52
5+35.0	1418.17	27.6	-16.83
[illegible]	1417.89	28.6	-17.11
[illegible]	[illegible]	29.6	-17.37
[illegible]	1417.42	30.6	[illegible]
[illegible]	1417.25	31.6	-17.75
[illegible]	[illegible]	32.6	[illegible]
[illegible]	[illegible]	33.6	[illegible]

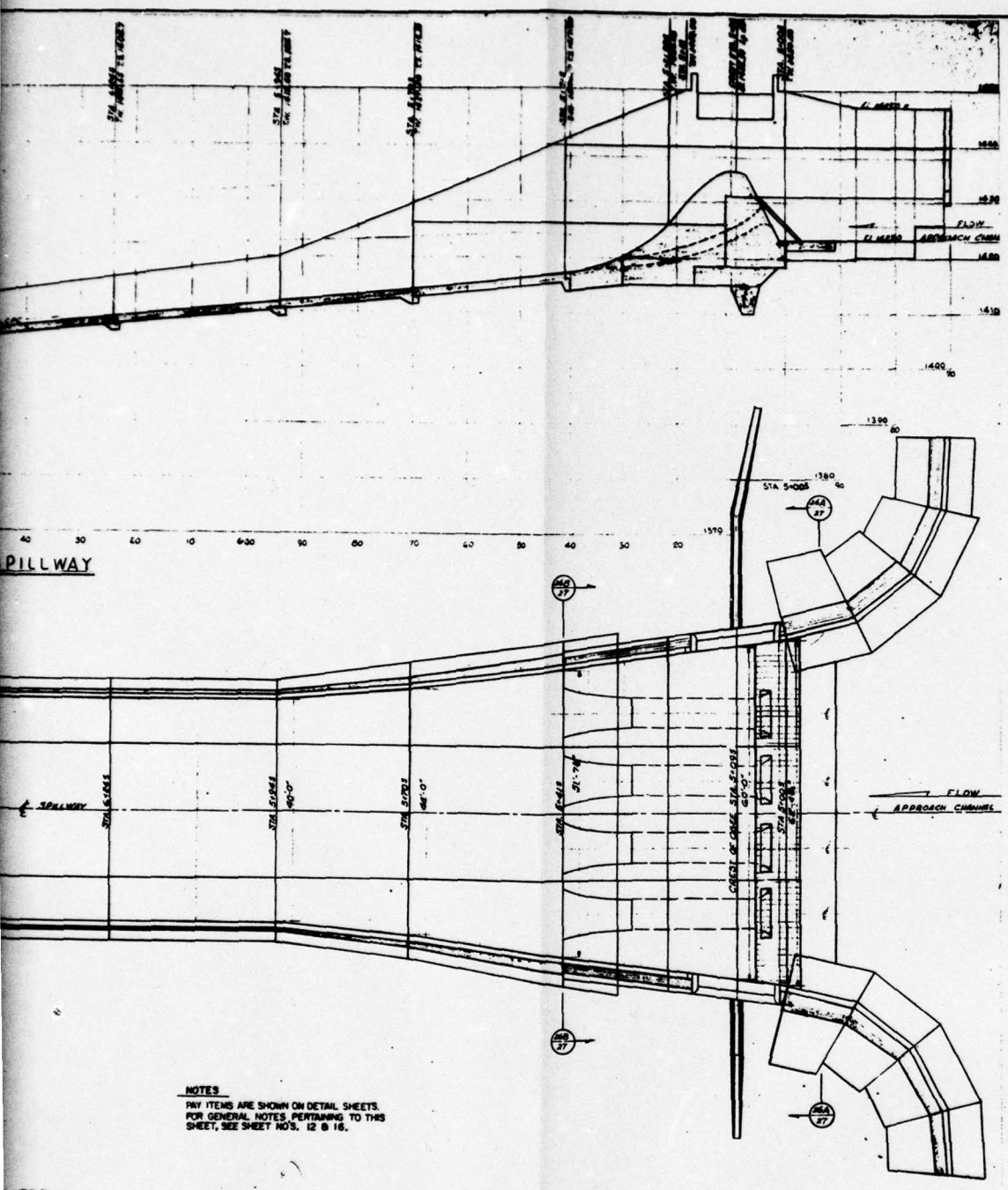


SLUICE COORDINATES
LOWER CURVE

STATION	ELEVATION	X_2	Y_2
5+02.90	1426.00	0	0
5+03.20	1426.23	0.30	+0.23
5+03.45	1426.08	0.55	+0.08
5+04.10	1426.15	1.20	+0.15
5+04.50	1426.00	1.60	0.00
5+05.00	[illegible]	2.10	-0.20
5+07.00	[illegible]	4.10	-1.20
5+09.00	[illegible]	6.10	-2.22
5+11.00	[illegible]	8.10	-3.17
[illegible]	[illegible]	10.10	-4.02
[illegible]	[illegible]	12.10	-4.77
5+17.00	[illegible]	14.10	-5.45
[illegible]	[illegible]	16.10	-6.08
[illegible]	[illegible]	18.10	-6.65
[illegible]	[illegible]	20.10	-6.97
[illegible]	[illegible]	22.10	-7.31
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

SLUICE COORDINATES
UPPER CURVE

STATION	ELEVATION	X_4	Y_4
5+04.455	1429.10	0	0
5+04.50	1428.80	0.05	-0.30
5+04.70	1428.45	0.25	-0.65
5+05.10	1428.13	0.65	-0.97
5+05.50	[illegible]	1.05	-1.25
5+05.95	[illegible]	1.50	-1.52
5+08.00	[illegible]	3.55	-2.57
5+10.00	[illegible]	5.55	-3.58
5+12.00	[illegible]	7.55	[illegible]
5+14.00	[illegible]	9.55	-5.35
5+16.00	[illegible]	11.55	-6.15
5+18.00	[illegible]	13.55	-6.89
5+20.00	1421.20	15.55	-7.50
[illegible]	[illegible]	17.55	-8.04
[illegible]	[illegible]	19.55	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]



NOTES

PAY ITEMS ARE SHOWN ON DETAIL SHEETS.
FOR GENERAL NOTES PERTAINING TO THIS SHEET, SEE SHEET NO'S. 12 & 16.

GANNETT FLEMING CORDDRY & CARPENTER INC.
CONSULTING ENGINEERS
600 NORTH SECOND STREET HARRISBURG, PA.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

GLENDALE DAM

SPILLWAY
PLAN & PROFILE

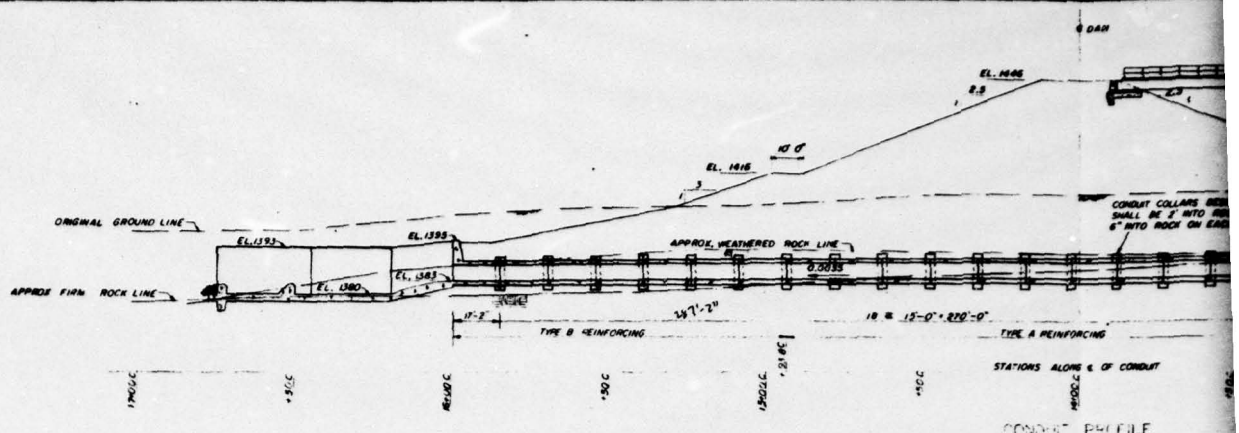
BEAVERDAM RUN CAMBRIA COUNTY GLENDALE, PENNA.

SCALE 1"=10'-0" SHEET NO. 9A

PLATE 9

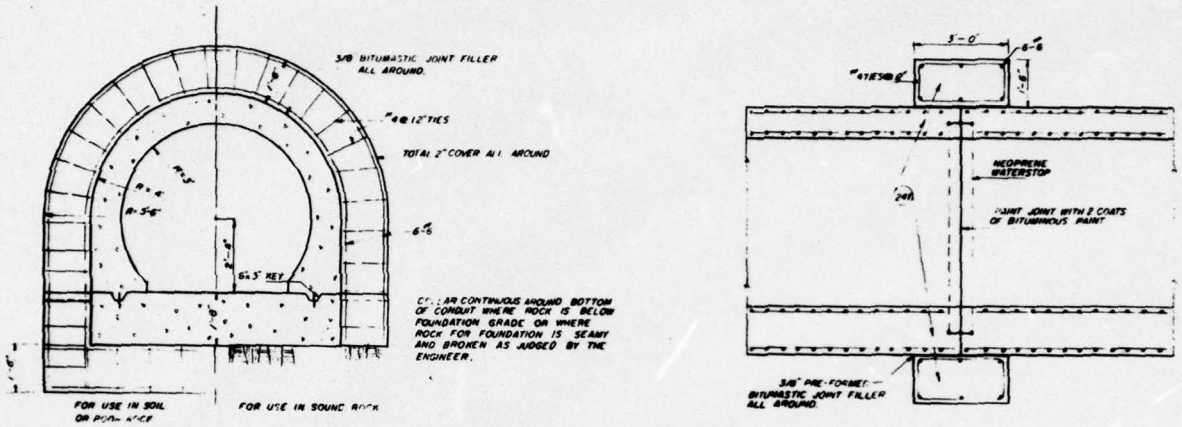
D'APPOLONIA

DRAWN BY	DJD	CHECKED BY	BE	9-15-78	DRAWING NUMBER 78-4-B131
	8-31-78	APPROVED BY	[illegible]	9-18-78	



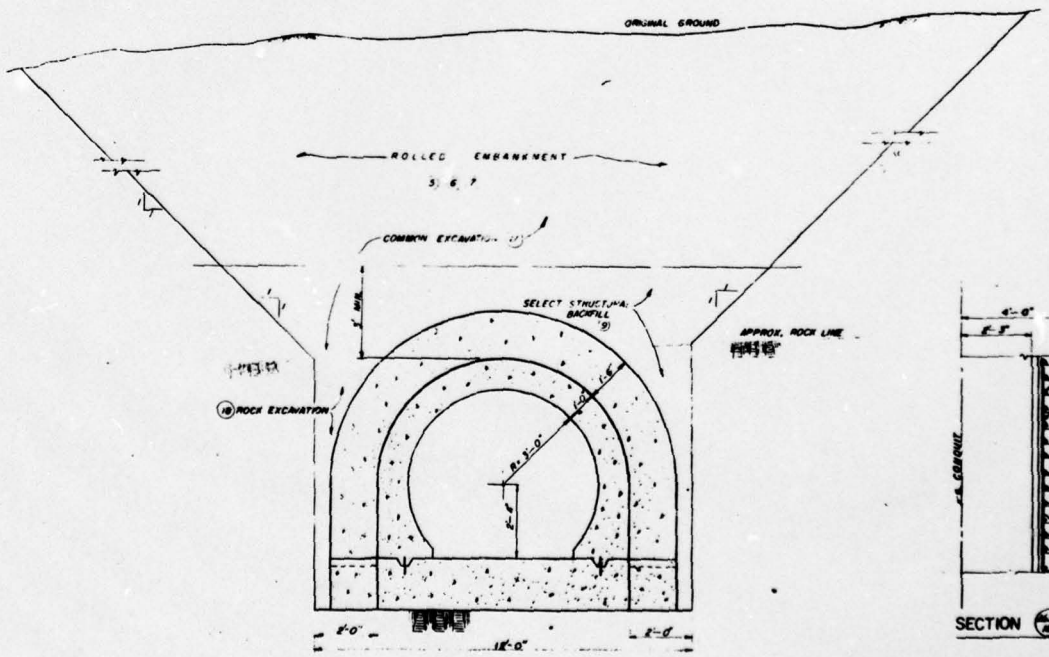
CONDUIT PROFILE

SCALE 1" = 20'-0"



JOINT COLLAR DETAILS

SCALE 1/2" = 1'-0"

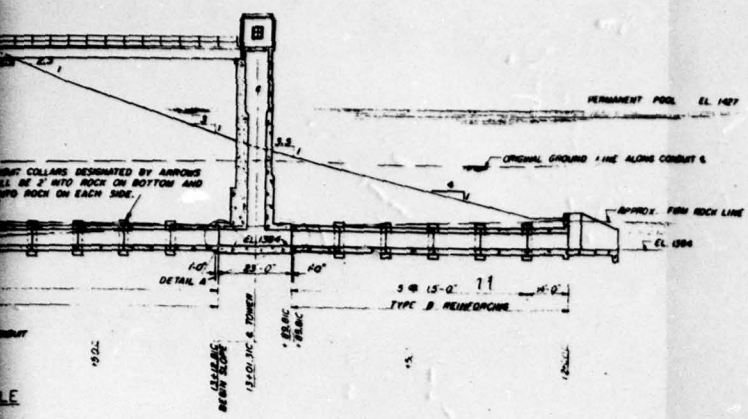


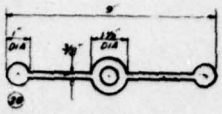
TRENCH DETAIL

SCALE 1/2" = 1'-0"

SECTION

SCALE 1/2" = 1'-0"

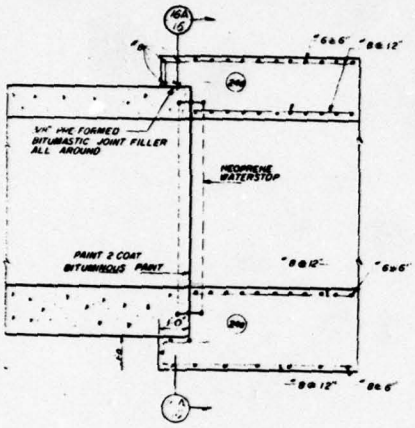




NEOPRENE WATERSTOP

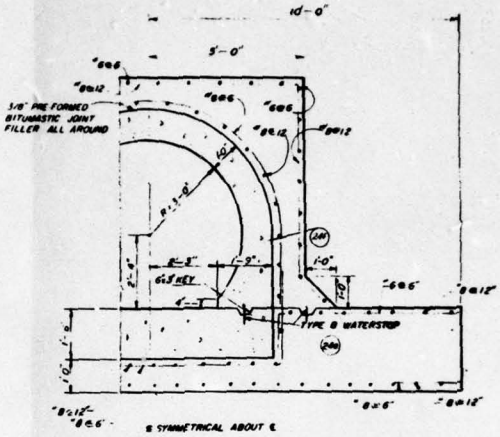
SCALE 3" = 1'-0"

NOTE: 9" NEOPRENE WATERSTOP SHALL BE PROVIDED AT ALL TRANSVERSE JOINTS OF CONDUIT.



SECTION

SCALE 1/2" = 1'-0"



SECTION

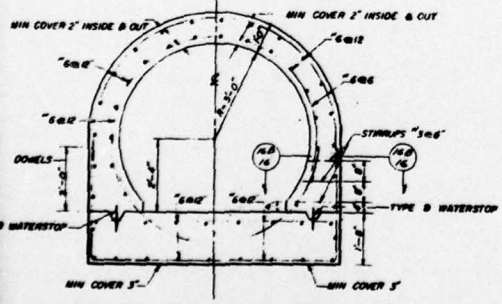
SCALE 1/2" = 1'-0"

TYPE B REINFORCING

STA. 12+ C TO STA. 12+89.8
STA. 14+53.8IC TO STA. 14+00C

TYPE A REINFORCING

STA. 13+18.8IC TO STA. 14+93.8IC



CONDUIT REINFORCING DETAILS

SCALE 1/2" = 1'-0"

GENERAL NOTES

1. MINIMUM COVER OVER REINFORCING IN THE VARIOUS PARTS OF THE WORK SHALL BE AS FOLLOWS:
   4"- TOP AND BOTTOM OF CHUTE AND STILLING BASIN SLABS.
   3"- SPILLWAY AND CONDUIT OUTLET WALLS IN SECTIONS THICKER THAN 18", TOWER FOOTINGS AND WALLS IN SECTIONS THICKER THAN 15", AND CONDUIT FOOTING.
   2"- CONDUIT ARCH AND WALL SECTIONS 18" OR THINNER
   1"- BRIDGE SLAB & FLOORS IN CONTROL TOWER
   EXCEPTIONS TO THE ABOVE SHALL BE AS NOTED.
2. ALL BARS TO BE DETAILED IN ACCORDANCE WITH A.C.I. CODE UNLESS OTHERWISE NOTED
3. NO OTHER CONSTRUCTION JOINT THAN THOSE SHOWN SHALL BE MADE WITHOUT APPROVAL OF THE ENGINEER
4. ALL EXPOSED CONCRETE EDGES SHALL BE CHAMFERED 1/2" UNLESS OTHERWISE NOTED.

NO.	DATE	REVISION	REV.	CHK.	APPR.

GANNETT FLEMING CORDDRY & CARPENTER INC.
CONSULTING ENGINEERS
600 NORTH SECOND STREET HARRISBURG, PA.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

GLENDALE DAM

CONDUIT

PROFILE & DETAILS

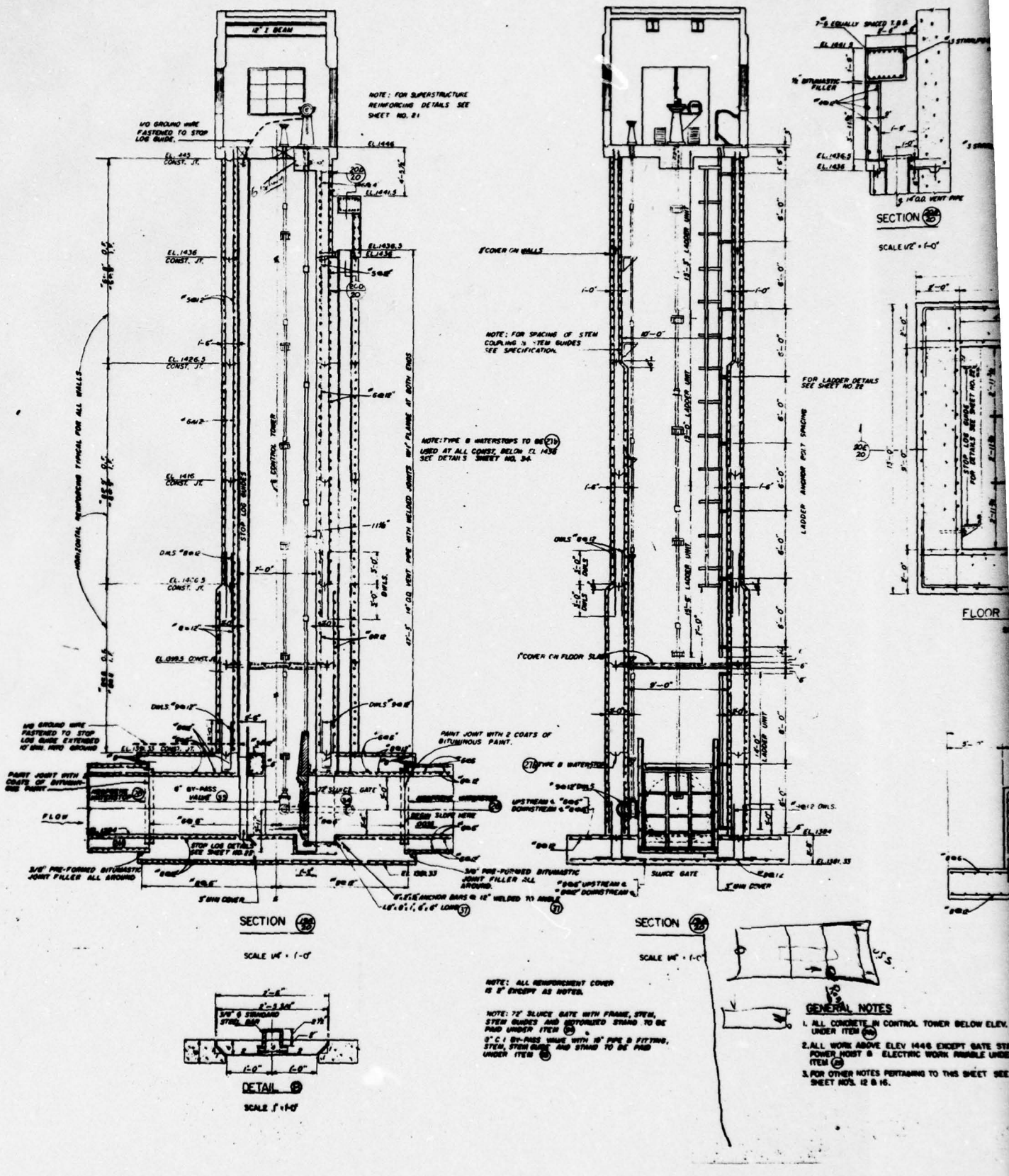
BEAVERDAM RUN — CAMBRIA COUNTY — GLENDALE, PENN

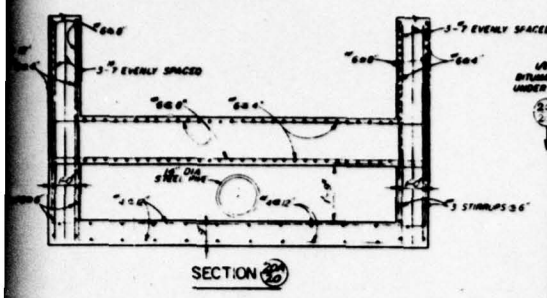
SCALE AS SHOWN — SHEET NO. 16

PLATE 10

D'APPOLONIA

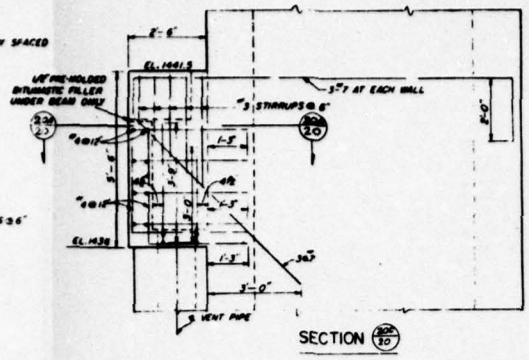
DRAWN BY	DJD	CHECKED BY	RE	9-15-78	DRAWING NUMBER 78-4-B130
	8-31-78	APPROVED BY	[illegible]	9-15-78	





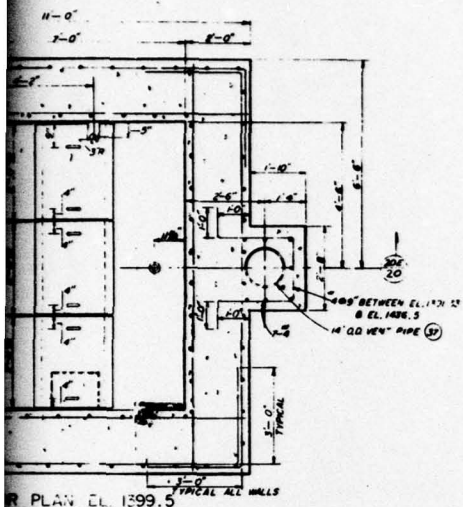
SECTION 204/20

SCALE 1/2" = 1'-0"



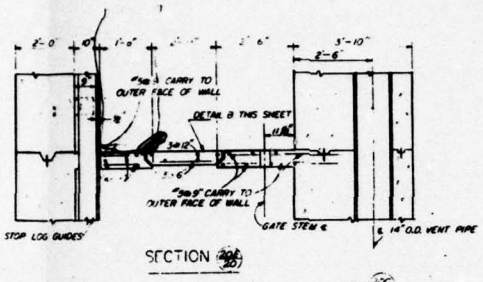
SECTION 203/20

SCALE 1/2" = 1'-0"

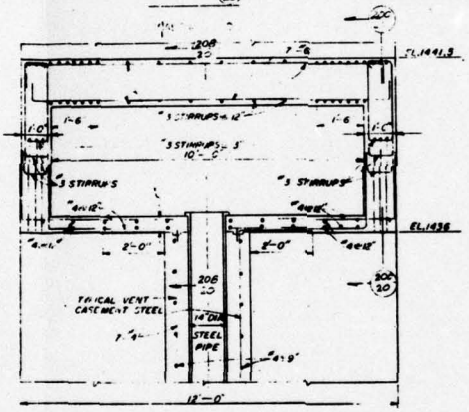


R PLAN EL. 1399.5

SCALE 1/2" = 1'-0"

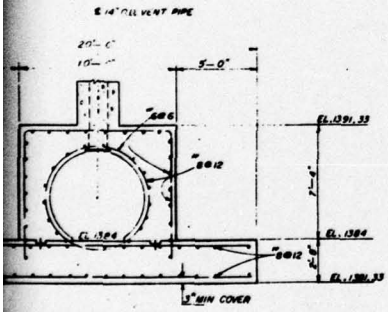


SECTION 206/20



SECTION 200/20

SCALE 1/2" = 1'-0"



SECTION 202/20

SCALE 1/4" = 1'-0"

GANNETT FLEMING CORDDRY & CARPENTER
CONSULTING ENGINEERS
600 NORTH SECOND STREET HARRISBUR

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

GLENDALE DAM
CONTROL TOWER
GENERAL DETAILS

BEAVERDAM RUN GLENDALE
CAMBRIA COUNTY
SCALE AS SHOWN SHEET N

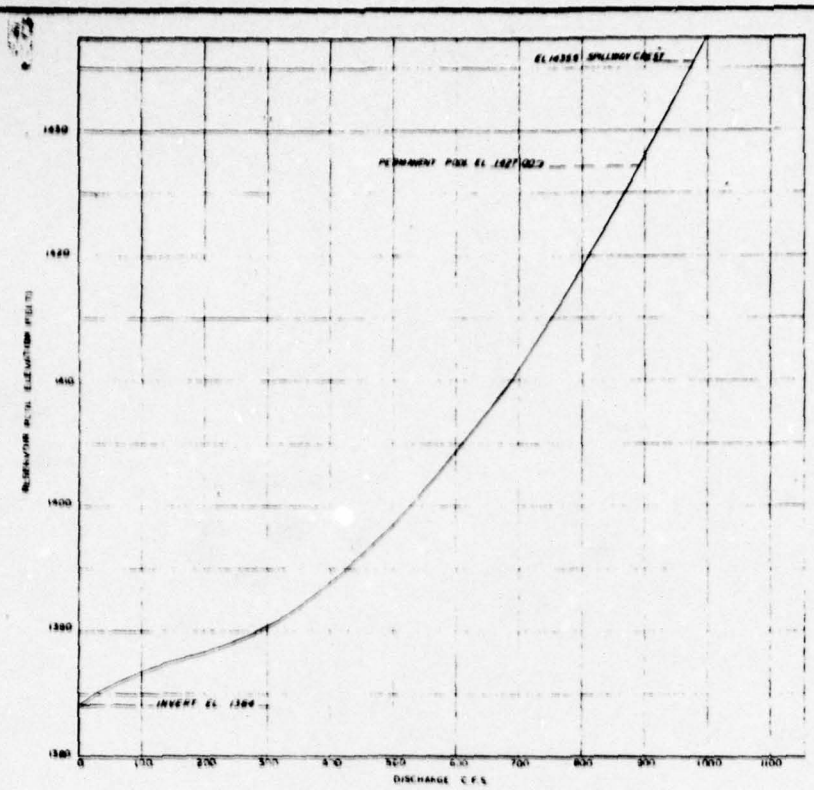
DESIGNED MA
DRAWN EGJ
TRACED EGJ
CHECKED FB

RECOMMENDED
APPROVED

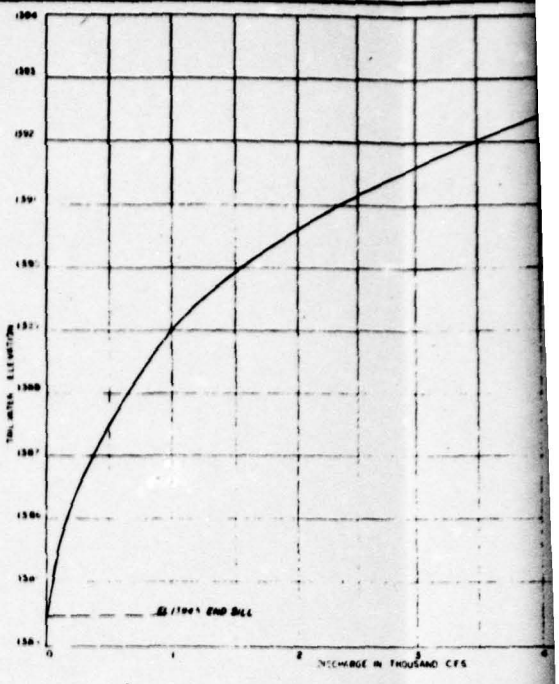
PLATE II

D'APPOLONIA

DRAWN BY	DJD	CHECKED BY	AC	DRAWING NUMBER	78-4-B136
	8-31-78	APPROVED BY	[illegible]		

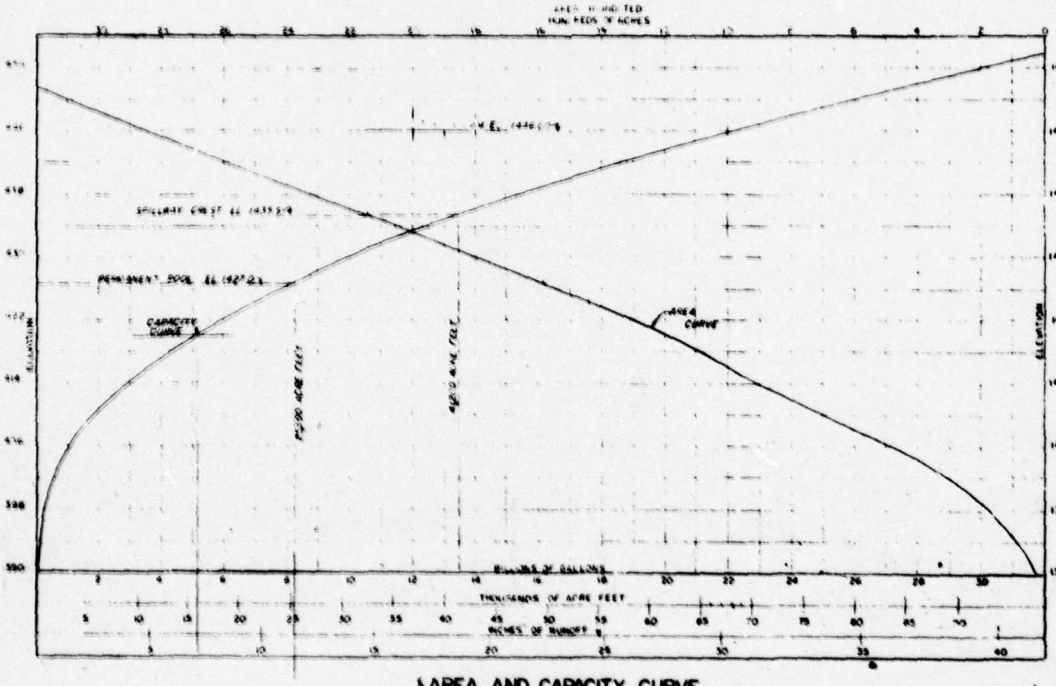


RATING CURVE FOR OUTLET CONDUIT

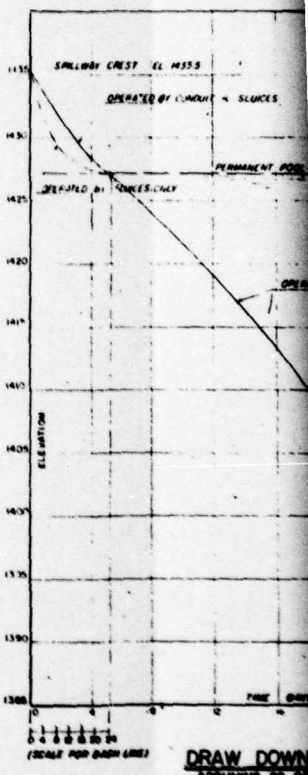


TAILWATER RATING CURVE

SPILLWAY OUTLET CHANNEL AT END SILL



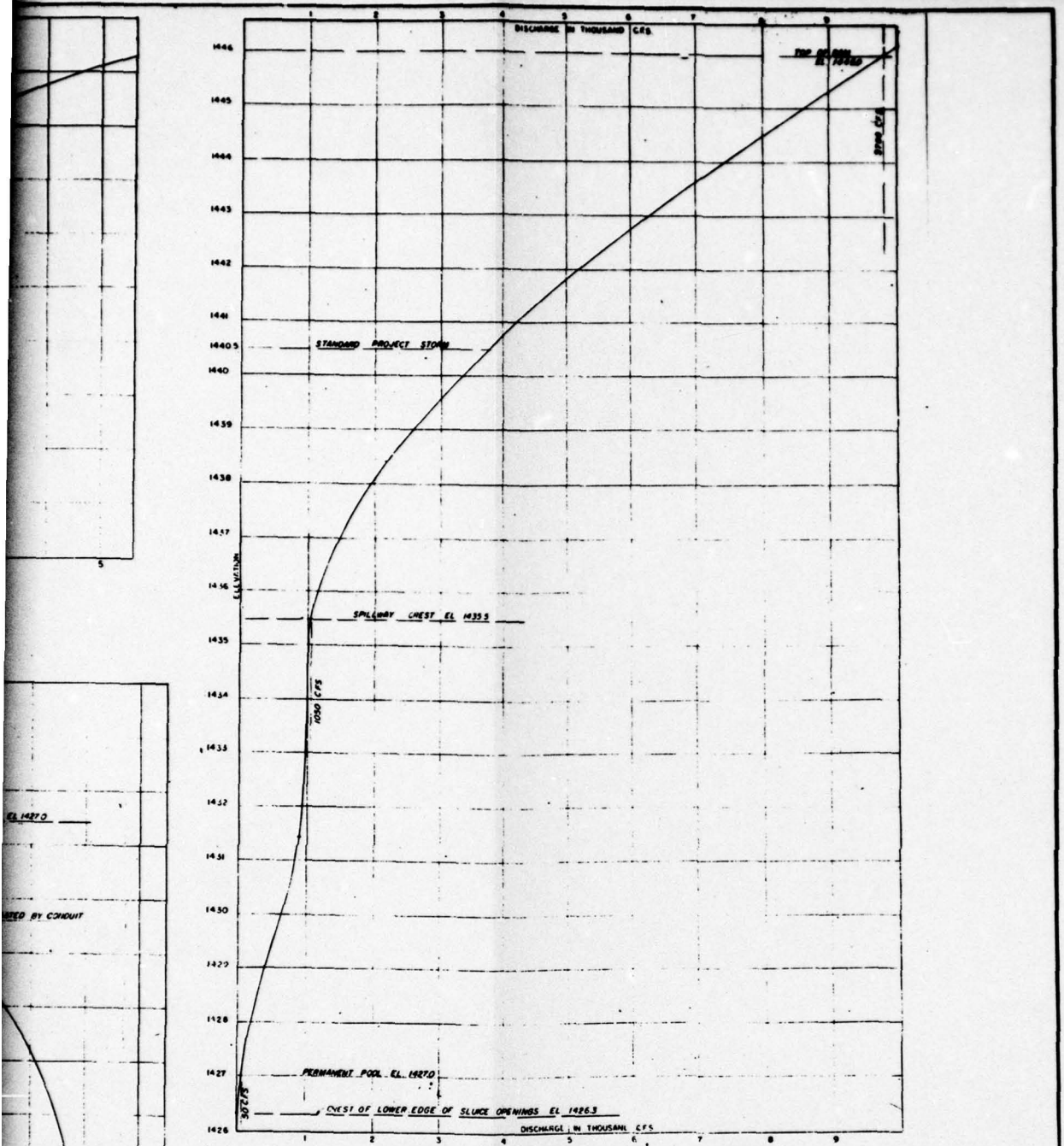
AREA AND CAPACITY CURVE



DRAW DOWN

ASSUMING 30 C

GATE FULLY



XRATING CURVE FOR SPILLWAY & SLUICES

GANNETT FLEMING CORDDRY & CARPENTER INC.
CONSULTING ENGINEERS
600 NORTH SECOND STREET HARRISBURG, PA.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

GLENDALE DAM

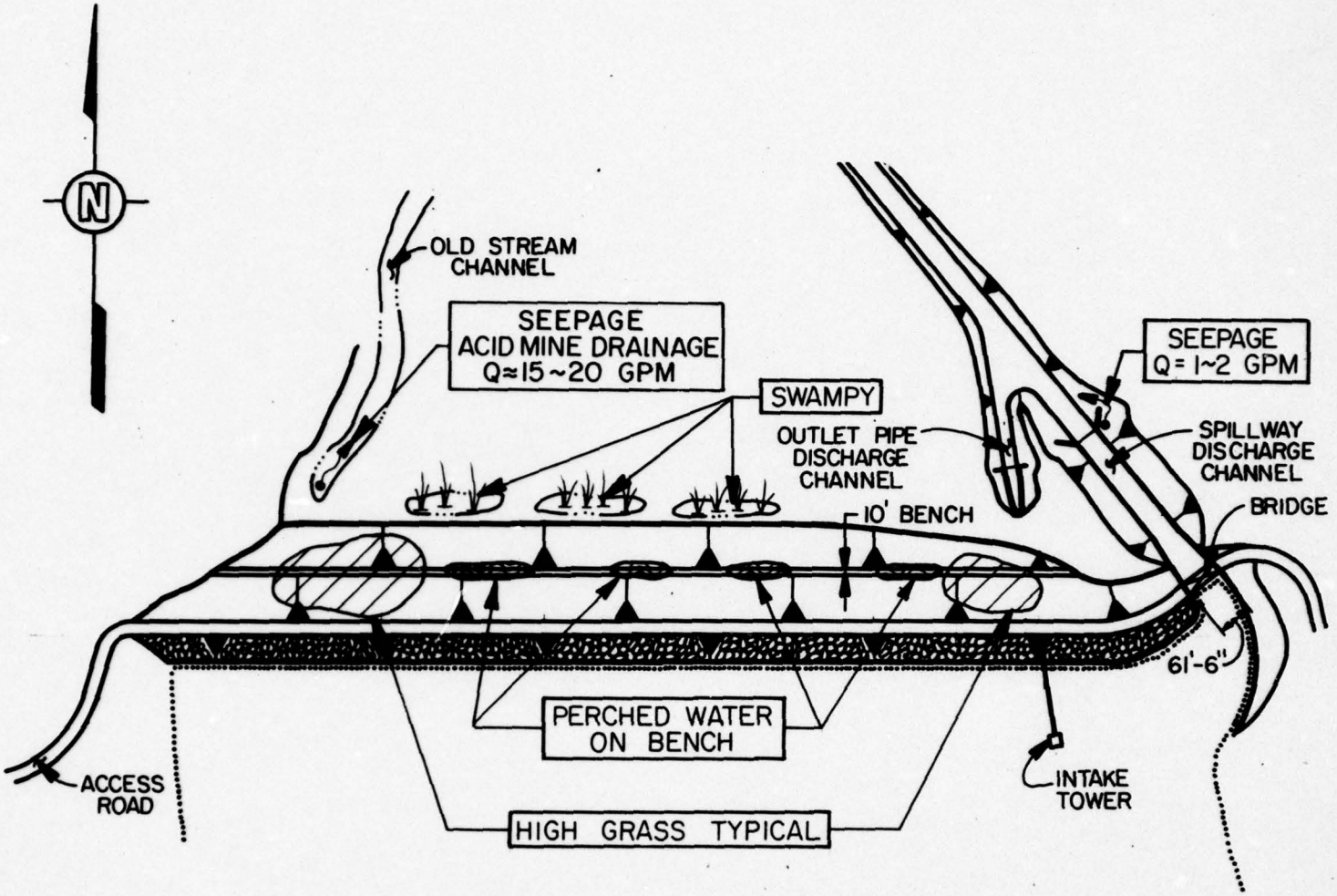
HYDRAULIC CHARACTERISTIC CURVES

BEAVERDAM RUN GLENDALE, PENN
CAMBRIA COUNTY
SCALE AS SHOWN SHEET NO. 4

PLATE 12

D'APPOLONIA

DRAWN BY	D.J.D.	CHECKED BY	BE	9-15-78	DRAWING NUMBER 78-14-A29
	8-21-78	APPROVED BY	JMP	9-15-78	



POOL EL. DATE OF INSPECTION ≈ 18'-6" BELOW DAM CREST
(STAFF GAGE READING 1427.34)

NOT TO SCALE

PLATE 13

GLENDALE DAM NDI: 912
GENERAL PLAN
FIELD INSPECTION NOTES
FIELD INSPECTION DATE: AUGUST 9, 1978

D'APPOLONIA

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

CHECKLIST
VISUAL INSPECTION
PHASE I

NAME OF DAM GLENDALE DAM COUNTY CAMBRIA STATE PA ID# NDI: 912
DER: 11-101

TYPE OF DAM EARTH FILL HAZARD CATEGORY HIGH

DATE(S) INSPECTION AUG. 9, 1978 WEATHER PRTLY CLOUDY TEMPERATURE 70's

POOL ELEVATION AT TIME OF INSPECTION 1427 M.S.L. TAILWATER AT TIME OF INSPECTION 1385 M.S.L.

INSPECTION PERSONNEL:

BILGIN EREL

REVIEW INSPECTION BY: ELIO D'APPOLONIA
AUG 16, 1978

L. D. ANDERSEN

JAMES POLLOT

BILGIN EREL RECORDER

VISUAL INSPECTION
PHASE I
EMBANKMENT

NAME OF DAM GLENDALE DAM

ID# NDI : 912 DER: 11-101

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NONE	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	NONE	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	NONE	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	NO PERCEIVABLE MISALIGNMENT	
RIPRAP FAILURES	NONE	

VISUAL INSPECTION
PHASE I
EMBANKMENT

NAME OF DAM GLENDALE DAM
ID# NDI: 917 DER: 11-101

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	ACID MINE DRAINAGE SEEPAGE AT THE JUNCTION OF LEFT ABUTMENT AND EMBANKMENT AT TOE LEVEL. FLOW ≈ 15~20 GPM	MONITOR & RECORD THIS FLOW.
ANY NOTICEABLE SEEPAGE	MINOR SEEPAGE RIGHT OF STILLING BASIN (FLOW: 1~2 GPM)	
STAFF GAGE AND RECORDER	ON THE ACCESS BRIDGE TO INTAKE TOWER (STATE'S GAGE). IN THE INTAKE TOWER U.S.G.S. CONTINIOUS RECORDING EQUIPMENT.	
DRAINS	NONE	

VISUAL INSPECTION
PHASE I
CONCRETE/MASONRY DAMS

NAME OF DAM GLENDALE DAM
ID# NDI : 912 DER: 11-101

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	EARTH DAM ∴ N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

VISUAL INSPECTION
PHASE 1
CONCRETE/MASONRY DAMS

NAME OF DAM GLENDALE DAM

ID# NDI : 912 DER: 11-101

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	EARTH DAM N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS STAFF GAGE OF RECORDER:	N/A	

VISUAL INSPECTION
PHASE I
OUTLET WORKS

NAME OF DAM GLENDALE DAM
ID# NDI : 912 DER : 11-101

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	5.5 FT x 6.0 FT HORSESHAPED CONDUIT. THE CONDUIT WAS HALF FULL DUE TO BACK WATER FROM THE STREAM. ∴ NO INSPECTED.	
INTAKE STRUCTURE	WET TOWER. VISIBLE PORTIONS IS IN GOOD CONDITION.	
OUTLET STRUCTURE	STILLING BASIN. GOOD CONDITION	
OUTLET CHANNEL	RIPRAPPED EARTH CHANNEL GOOD CONDITION,	
EMERGENCY GATE	OPERATED BY STATE PERSONNEL AND OBSERVED TO BE FUNCTIONAL. (MOTOR OPERATED SLUICE GATE)	

VISUAL INSPECTION
PHASE I
UNGATED SPILLWAY

NAME OF DAM GLENDALE DAM
ID# NDI: 912 DER: (1-10)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	EMERGENCY: 60-FT OGEE SECTION PRIMARY: 4-ORIFICES THROUGH OGEE SECTION (BOTH IN GOOD CONDITION)	
APPROACH CHANNEL	FREE OF DEBRIS. FLOATING TRASH BOOM WAS BROKEN.	
DISCHARGE CHANNEL	CONCRETE CHUTE. GOOD CONDITION.	
BRIDGE AND PIERS	BRIDGE ACCROSS THE SPILLWAY (SEE PLATE 8)	

VISUAL INSPECTION
PHASE I
GATED SPILLWAY

NAME OF DAM GLENDALE DAM
ID# NDI: 912 DER: 11-101

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	(NO GATED SPILLWAY) N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

VISUAL INSPECTION
PHASE 1
INSTRUMENTATION

NAME OF DAM GLENDALE DAM
ID# NDI: 912 DER: 11-101

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	NONE	
OBSERVATION WELLS	NONE	
WEIRS	NONE	
PIEZOMETERS	NONE	
OTHER	NONE	

VISUAL INSPECTION
PHASE I
RESERVOIR

NAME OF DAM GLENDALE DAM
ID# NDI:912 DER:11-101

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	GENLE, PARK GROUNDS	
SEDIMENTATION	UNKNOWN.	

VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

NAME OF DAM GLENDALE DAM

ID# NDI: 912 DER: 11-101

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	MEANDERS THROUGH A 1500~2000 FT WIDE VALLEY. CHANNEL 40~50 FT WIDE BANK FULL 4~5 FT DEEP.	
SLOPES	N/A.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	COMMUNITY OF BEAVER VALLEY ONE MILE DOWNSTREAM. (~25 HOMES, POPULATION ≈ 100) TOWN OF COALPORT FOUR MILES DOWNSTREAM.	

APPENDIX B

CHECKLIST
ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION
PHASE I

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM GLENDALE DAM
ID# NDI: 912 DER: 11-101

ITEM	REMARKS
AS-BUILT DRAWINGS	AVAILABLE IN STATE FILES.
REGIONAL VICINITY MAP	SEE PLATE 2.
CONSTRUCTION HISTORY	DESIGNED BY GANNETT, FLEMING, CORDRY AND CARPENTER INC. OF HARRISBURG. (1956~1958) CONSTRUCTION COMPLETED 1960
TYPICAL SECTIONS OF DAM	SEE PLATE 3
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	SEE PLATES 10 & 11

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM GLENDALE DAM
ID# NDI:912 DER:11-101

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	RESERVOIR LEVELS RECORDED BY THE STATE & U.S.G.S.
DESIGN REPORTS	1. SOILS REPORT BY BERGER ASSOCIATES INC. OF HARRISBURG, PA (NO DATE) 2. A DESIGN REVIEW REPORT BY GANNETT, FLEMING CORDDRY & CARPENTER INC. HARRISBURG, PA FEB 27, 1958
GEOLOGY REPORTS	INCLUDED IN BERGER REPORT
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	RESULTS OF H & H CALCULATION INCLUDED IN 1958 REPORT. STABILITY ANALYSIS NOT AVAILABLE
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	IN BERGER REPORT & DRAWINGS.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM GLENDALE DAM.
ID# NDI:912 DER: 11-101

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	NONE REPORTED.
BORROW SOURCES	LAKE AREA
MONITORING SYSTEMS	NONE
MODIFICATIONS	NONE
HIGH POOL RECORDS	EL. 1431.63 JUNE 24, 1972 (FROM U.S.G.S RECORDS)

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM GLENDALE DAM
ID# NDI:912 DER:11-101

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	NONE REPORTED
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	NONE REPORTED
MAINTENANCE OPERATION RECORDS	AVAILABLE IN STATE FILES.
SPILLWAY PLAN SECTIONS DETAILS	SEE PLATES 8 & 9
OPERATING EQUIPMENT PLANS AND DETAILS	SEE PLATES 10 & 11

NAME OF DAM GLENDALE DAM

ID# NDI: 912 DER 11-101

CHECKLIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 41.9 SQ. MILES WOODED

ELEVATION; TOP NORMAL POOL AND STORAGE CAPACITY: 25,300 AC-FT @ EL 1427

ELEVATION; TOP FLOOD CONTROL POOL AND STORAGE CAPACITY: 41,200 AC-FT @ EL 1435.5

ELEVATION; MAXIMUM DESIGN POOL: EL 143.5

ELEVATION; TOP DAM: EL 1446

CREST: EMERGENCY SPILLWAY

a. Elevation EL 1435.5

b. Type OGEE

c. Width 60'-0

d. Length N/A

e. Location Spillover N/A

f. Number and Type of Gates NONE

OUTLET WORKS:

a. Type 5'-4" x 6'-0 HORSESHAPED CONCRETE CONDUIT.

b. Location NEAR RIGHT ABUTMENT

c. Entrance Inverts EL 1384

d. Exit Inverts EL 1385

e. Emergency Draindown Facilities OUTLET CONDUIT.

HYDROMETEOROLOGICAL GAGES:

a. Type STAFF GAGE

b. Location AT INTAKE TOWER

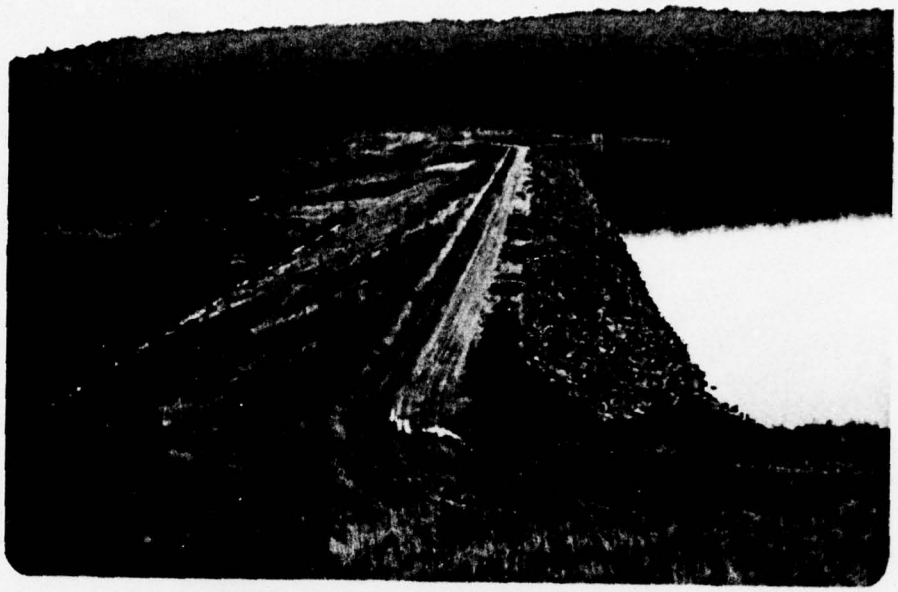
c. Records STATE & USGS.

MAXIMUM NONDAMAGING DISCHARGE: @ 3000 CFS FLOODING OF DOWNSTREAM RESIDENTS.

APPENDIX C
PHOTOGRAPHS

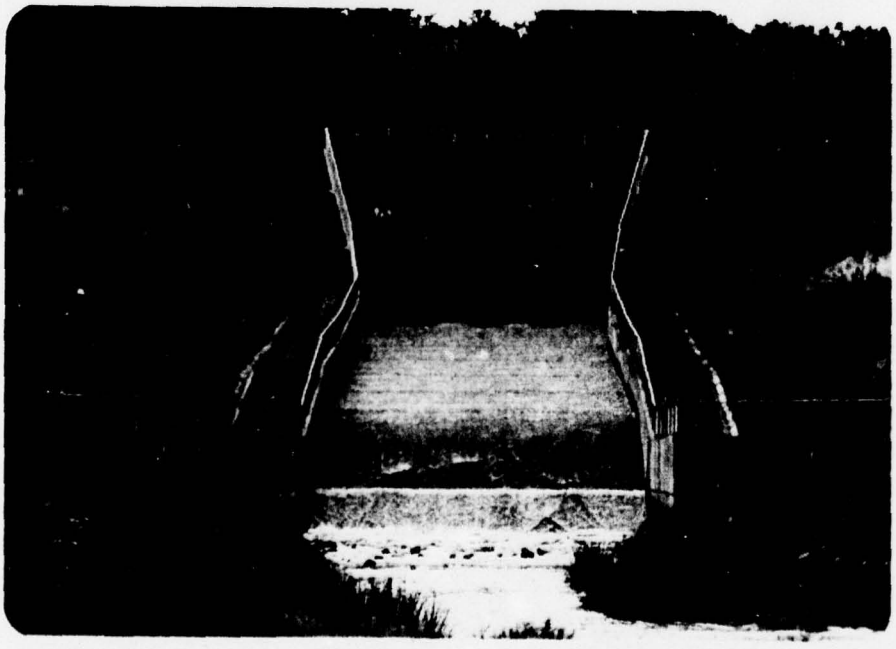
LIST OF PHOTOGRAPHS
GLENDALE DAM
NDI I.D. NO.
AUGUST 9, 1978

PHOTOGRAPH NO.	DESCRIPTION
1	Crest.
2	Spillway chute.
3	Spillway crest.
4	Spillway discharge channel.
5	Intake tower.
6	Outlet pipe gate control.
7	Outlet pipe discharging.
8	Acid mine drainage (left abutment at toe level).
9	Acid mine drainage (closeup).
10	First downstream bridge (about one mile downstream).



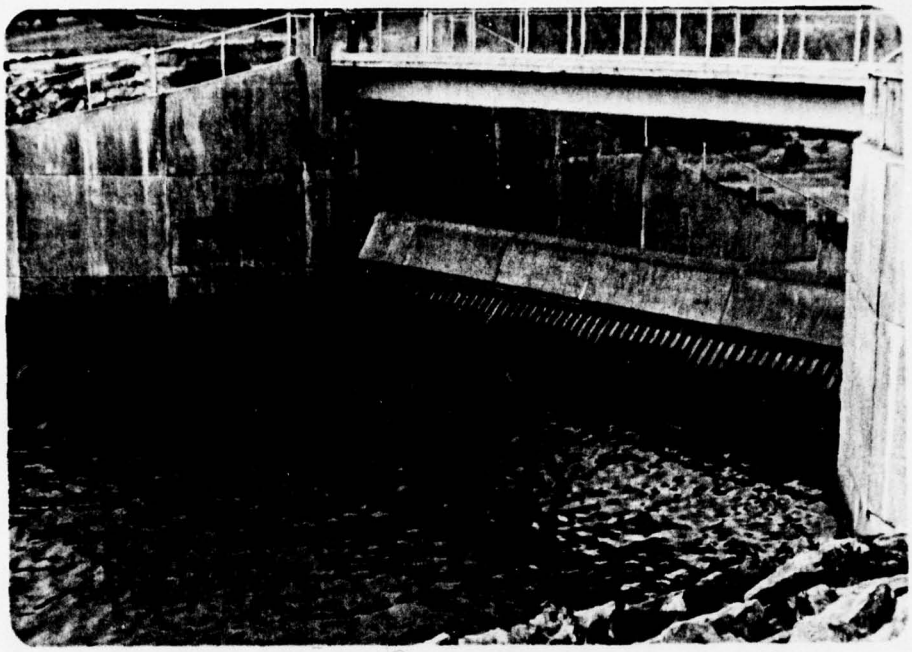
Photograph No. 1

Crest.



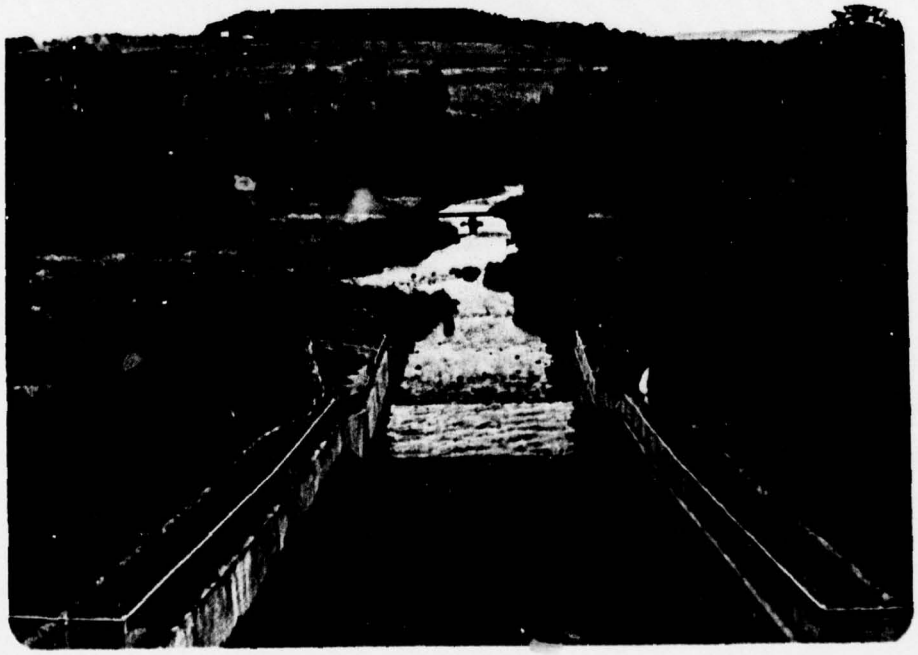
Photograph No. 2

Spillway chute.



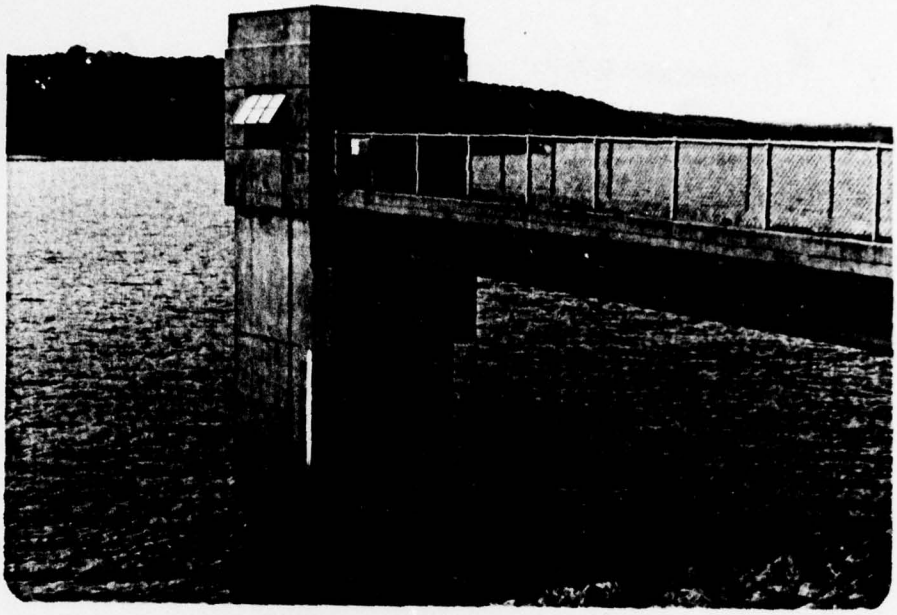
Photograph No. 3

Spillway crest.



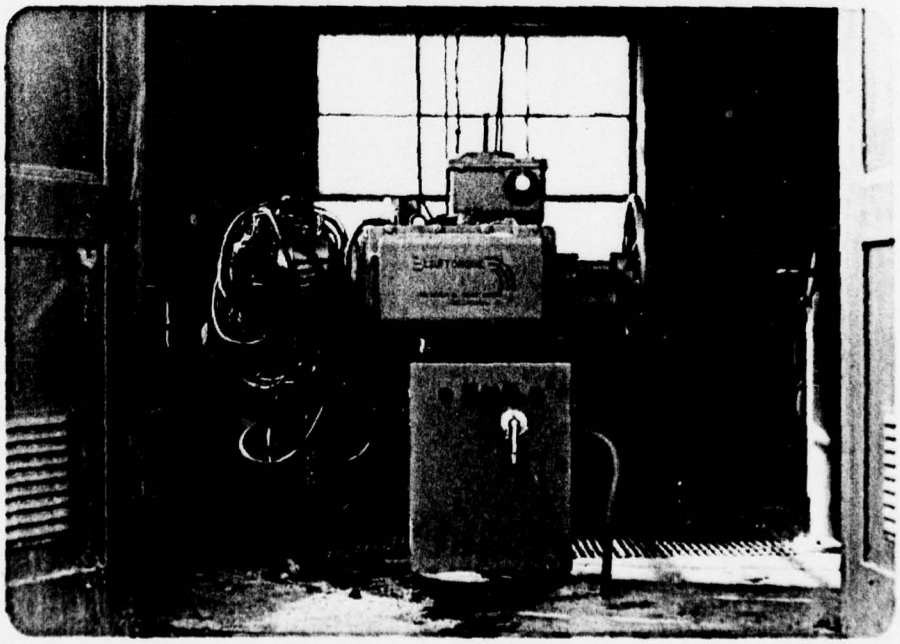
Photograph No. 4

Spillway discharge channel.



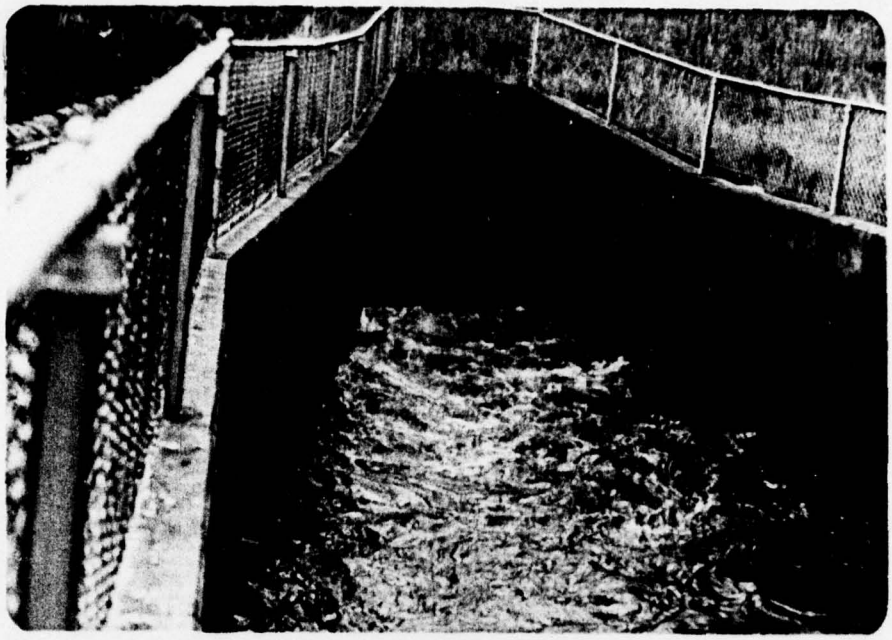
Photograph No. 5

Intake tower.



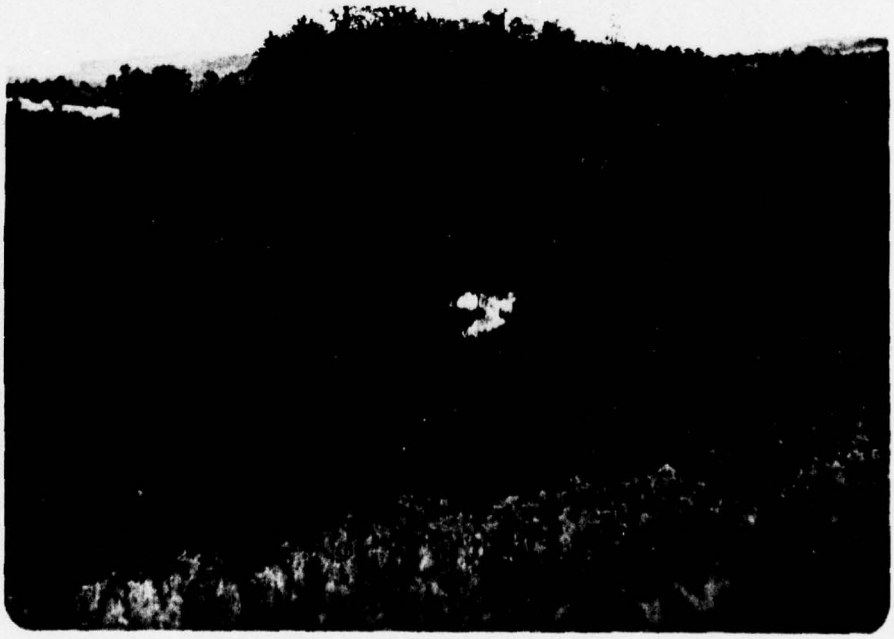
Photograph No. 6

Outlet pipe gate control.



Photograph No. 7

Outlet pipe discharging.

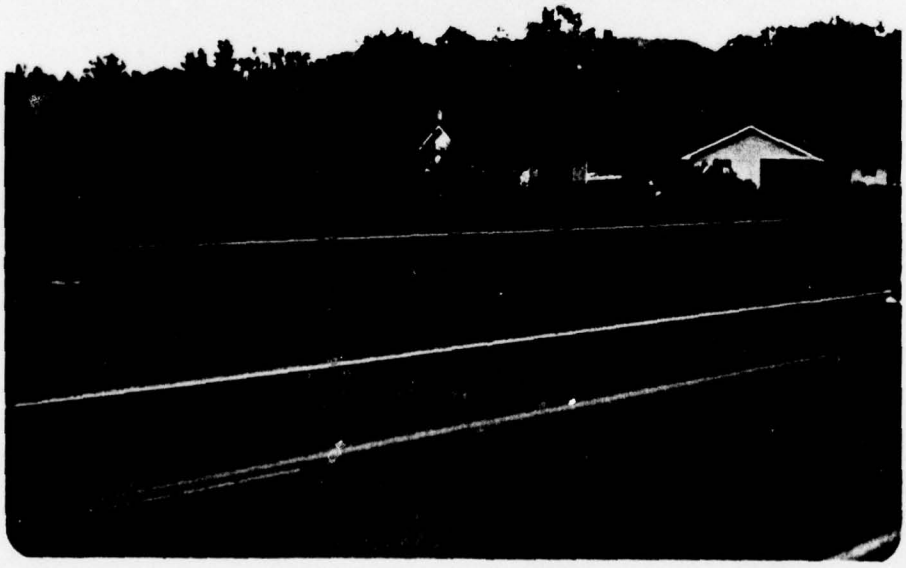


Photograph No. 8

Acid mine drainage (left abutment at toe level).

Photograph No. 9

Acid mine drainage (closeup).



Photograph No. 10

First downstream bridge (about one mile downstream).

APPENDIX D
CALCULATIONS

D'APPOLONIA
CONSULTING ENGINEERS, INC

By WTC Date 9-13-78 Subject GLENDALE DAM Sheet No. 1 of 3
Chkd. By BE Date 9-15-78 HYDROLOGY & HYDRAULICS Proj. No. 78-114-25

DAM GLENDALE DAM, CAMBRIA COUNTY, PA

BASIN: BEAVERDAM RUN, SUSQUEHANNA RIVER, REGION #1

WATERSHED AREA $A = 41.9$ SQ. MI

ACCORDING TO COE BALTIMORE DIST. CHARTS

MAX. INFLOW $Q = 1480^{cfs}/SQ.MI$
$= 62012$ cfs

VOL. of RUNOFF (26") $= \frac{26}{12} \times 41.9 \times 640$
$= 58101^{ac\text{-}ft}$

TRANSPOSE. DATA FROM CHEST CREEK DAM project WHICH HAS

$A_1 = 38$ SQ MI

$Q_1 = 64805$ cfs

USING 0.8 rule to transpose data

$$\left(\frac{A}{A_1}\right)^{0.8} = \left(\frac{Q}{Q_1}\right)$$

$$Q = Q_1 \left(\frac{A}{A_1}\right)^{0.8} = 64805 \left(\frac{41.9}{38}\right)^{0.8}$$

$= 70073^{cfs} > 62012^{cfs}$

use $Q = 70{,}100^{cfs}$
$V_1 = 58100^{ac\text{-}ft}$

D'APPOLONIA
CONSULTING ENGINEERS, INC

By WTC Date 9-13-78 Subject GLENDALE DAM Sheet No. 2 of 3
Chkd. By BE Date 9-15-78 HYDROLOGY & HYDRAULICS Proj. No. 78-114-25

SPILLWAY DISCHARGE RATING CURVES

REF. Dwg R11:1-1.4 By GANNETT FLEMING CORDDRY & CARPENTER INC, "GLENDALE DAM, HYDRAULIC CHARACTERISTIC CURVES"

ELEVATION	Q, cfs
1426.3 (CREST OF LOWER EDGE OF SLUICE OPENING)	0
1427.0*	50* (BASE FLOW)
1435.5 (SPILLWAY CREST)	1050
1440.5 (LEVEL OF STANDARD proj. storm)	3760
1446.0 (TOP OF DAM)	9780
1447.0 (projected)	11000* (projected) (*ACTUAL OVERTOPPING DISCHARGE NOT INCLUDED)

AREA & STORAGE RATING CURVES

ELEVATION	VOLUME, AC-ft	AREA, ACRES
1390	0	—
1427* (NORMAL POOL)	25,300	1590
1435.5 (SPILLWAY CREST)	41,200	
1446 (TOP OF DAM)	68100	2850
1454	92100	

* CREST LEVEL OF SILL ACROSS SPILLWAY (ASSUMED)

PERCENT OF PMF WITHOUT OVERTOPPING

$$= \left(\frac{9780-50}{70100} + \frac{68100-27100}{58100}\right) 100\%$$

(50 = Base flow)

$$= (0.14 + 0.71)\,100\%$$

$$= 84.5\%$$

Say 85% PMF

IF OVERTOPPING, DETERMINE WATER DEPTH, h, OVER TOP OF DAM

$$Q_s = (2.6)(1700)(h)^{1.5} + [9780 + (11000-9780)h]$$

(2.6)(1700)(h)^1.5 = Dam Crest; 9780 cfs + (11000-9780)h = SPILLWAY)

$$V_s = 68100 + (92100-68100)h = 27100 \text{ cfs}$$

$$\frac{Q_s}{70100} + \frac{V_s}{58100} = 1$$

BY TRIAL & ERROR $h = 0.3316$ FT

Say 0.33'

$$Q_s = (2.6)(1700)(0.33)^{1.5} + [9780 + (11000-9780)(0.33)]$$
$$= 838 + 10183$$
$$= 11021 \text{ cfs}$$
$$V_s = 48920 \text{ ac-ft}$$

APPENDIX E

REGIONAL GEOLOGY

APPENDIX E
REGIONAL GEOLOGY

The Glendale Dam is located on strata of the lower portion of the Allegheny Group (Lower Pennsylvanian Age). The dam and reservoir are located west of the axis of the northeast trending Bradley Syncline, a shallow geologic trough with gently sloping limbs. The strata at the dam dip to the southeast. The strata in the area consist of interbedded dark gray to black shales, gray sandstones, claystones, and several coal seams. The shales comprise most of the strata. Several of the coal seams are minable and there are numerous strip mines and underground mines in the area. The major seam is the Lower Kittanning (B coal), which occurs at approximately Elevation 1450. There are two to three coal seams below the Lower Kittanning, but these are thin and not minable at present. According to available information, the dam has not been undermined.

The slopes around the reservoir are underlain by easily weathered fine-grained rocks, such as shales and claystones. The slopes are gentle. Shallow creep may be expected.